ENGINEERING CASE LIBRARY

ECL 256

DOUBLE ALKALI FLUE GAS DESULFURIZATION:
THE CIPS EXPERIENCE

A study of the efforts on an electric utility company to adopt a new approach to controlling emissions from a coal-burning power plant. The technical issues are examined as well as the associated legal and regulatory controversies.

Richard Myhre

Washington Internships for Students of Engineering (WISE) Program

Educating Prospective Engineers for Public Policy

DOUBLE ALKALI FLUE GAS DESULFURIZATION:
THE CIPS EXPERIENCE

by

Richard Myhre[1]

January 1983

Prepared as part of the 1981 Washington Internships for Students of Engineering (WISE) Program under the supervision of Dr. Paul Craig[2], 1981 WISE Faculty-Member-in-Residence. Revised and edited by Barry Hyman[3]. This work was supported by NSF Grant SED 791894. All opinions presented are those of the authors and do not in any way represent those of NSF, the author's institutions, or of individuals or other institutions referred to in the text.

[1]Mechanical Engineering Student, University of Wisconsin-Madison. Mr. Myhre's participation in WISE was sponsored by the American Society of Mechanical Engineers.

[2]Professor of Applied Science, University of California-Davis.

[3]Associate Professor, Program in Social Management of Technology, University of Washington.

TABLE OF CONTENTS

ACKNOWLEDGEMENT

We wish to thank the Central Illinois Public Service Company, the United States Environmental Protection Agency, and the American Society of Mechanical Engineers for all their help, understanding, and cooperation in the development of this case. Particular thanks go to Bruce Varner of EPA and Jerry Simpson of CIPS who not only critiqued earlier versions of this case but also provided insights which significantly enhanced our understanding of the critical issues. Professor Michael Ruby of the University of Cincinnati Department of Civil Engineering class-tested a draft version and he and his students provided extremely valuable feedback. We also wish to thank Mr. William J. Holhut and the American Power Conference for permission to reproduce the paper which makes up Exhibit C-1; and the Bureau of National Affairs for permission to reproduce an article from the Environment Reporter as Exhibit D-6.

Richard Myhre
Barry Hyman

INTRODUCTION

Central Illinois Public Service Company (CIPS) is an electric utility supplying 300,000 residential, commercial, and industrial customers in central and southern Illinois. Headquartered in Springfield, their service territory extends southward to include many of the vast coal fields of southern Illinois. Early in the 1970s, CIPS decided to build a new generating facility in rural Jasper County near Newton, Illinois. This plant would be designed to burn local high-sulfur Illinois coal and would incorporate a double alkali flue gas desulfurization system to meet the federal New Source Performance Standards (NSPS) of the Clean Air Act.

Double alkali flue gas desulfurization, also known as dual alkali FGD, was a relatively new technology to the utility industry at the time, previously having been demonstrated only on a 20 MW scale. But because of problems encountered with conventional lime/limestone FGD systems used by other power plants which burned high-sulfur coal, CIPS engineers decided in 1975 to build double alkali FGD as part of its 575 MW Newton Unit No. 1. When their double alkali FGD system came on line in December 1979, CIPS became operator of the largest double alkali flue gas desulfurization system in the country.

The story of CIPS' double alkali FGD system is an interesting one; it intertwines lawyers and engineers, bureaucrats and managers, construction delays, lawsuits, operating malfunctions, and cost escalations. The reasons why CIPS chose double alkali, the problems it encountered, and the successes it achieved, are the basis of this case study. The case is divided into six parts based on chronology and the theme of emphasis. Part A deals with the decision-making process by which CIPS chose double alkali FGD. Parts, B, C, and D discuss the legal fight between CIPS and the United States Environmental Protection Agency (EPA). There you meet an engineer who worked for EPA and learn of his role in the decision-making process. Parts E and F of this case describe CIPS' actual operating experience with the Newton I plant with the focus on the activities of a CIPS engineer in monitoring, evaluating, and modifying the performance of the DAFGD system.

Part A: DESIGN DECISION-MAKING

Background

Sulfur oxides are the most abundant gaseous pollutants emitted during coal combustion. Not only do these dangerous pollutants damage human lungs, they retard plant growth, combine with vapor in the atmosphere to form sulfuric acids which precipitate back to earth as acid rain, and are responsible for the corrosive decay of precious historic monuments such as the Greek Acropolis. Controlling the amount of sulfur oxides released to the atmosphere is essential. Under authority granted to it by the Clean Air Act to issue New Source Performance Standards for air pollutants from stationary facilities, EPA established a permissible level for sulfur dioxide emissions of 1.2 $lb/10^6 BTU$. Relevant sections of that standard are reproduced in Exhibit A-1.

The major technological approaches to control of sulfur oxide emissions are flue gas desulfurization, pre-combustion cleaning, or in-combustion removal processes. The technique examined in this case, flue gas desulfurization, involves the scrubbing of flue gases with chemical reagents to selectively remove sulfur oxides.

SO_x removal processes normally employ either an absorption or adsorption technique, followed in some cases by a means of separating the sorbent from treated gas for regeneration. More than 100 systems/processes have been proposed for sulfur oxide removal, but only a handful are presently commercially viable.[1] In the following paragraphs, we review two specific approaches to FGD.

FGD Options

The predominant scrubber technology in use today is the once-through lime or limestone slurry system. In this process an aqueous slurry of lime (CaO) or limestone ($CaCO_3$) utilizes the calcium reagent to react with SO_2 and SO_3 in the flue gas to produce $CaSO_3$ and smaller quantities of $CaSO_4$. The sulfated slurry waste is then discarded into landfills or ponds. Eight-eight percent of all FGD units in the United States presently use this lime/limestone throwaway process.[2]

---

[1] K.E. Yeager, "Coal Clean-Up Technology," Annual Review of Energy, Vol. 5, 1980, p. 371.

[2] Ibid., p. 372.

The advantages of lime/limestone scrubbing are the relative ease by which it can be incorporated into existing facilities and the ability to remove particulates as well as sulfur oxides (many sulfur scrubbing processes increase particulates). However, lime/limestone slurry systems have been plagued with reliability problems and operating and maintenance costs have traditionally been high. The need to dispose of large quantities of aqueous calcium sulfite/sulfate sludge in landfills or ponds has also been a problem, one which may become more costly yet depending on future solid waste regulations.

As in the limestone slurry system, double-alkali processes dispose of removed SO_2 as a throwaway calcium sludge. Unlike limestone, however, absorption of SO_2 and production of disposable waster are separated, with the addition of limestone or lime occurring outside the scrubber loop. The scrubbing step utilizes an aqueous solution of soluble alkali. The absorption reaction depends on gas/liquid chemical equilibrium and mass transfer rates of SO_x from flue gas to scrubbing liquid instead of limestone dissolution, the limiting factor in limestone scrubbing. So_x absorption efficiency in a double-alkali system is potentially higher than in a limestone system with the same physical dimensions and liquid-to-gas rates. Scaling and plugging in the absorption area are reduced because calcium slurry is confined to the regeneration and disposal loop and soluble calcium is minimized in the scrubber liquor. Although double alkali systems could be expected to have higher capital costs than lime/limestone systems, this is offset by lower operating and maintenance expenses.

Further details of the technical characteristics of these FGD processes are contained in the first part of Exhibit A-2, which is a paper delivered at the 1976 American Power Conference by engineers involved in developing the FGD system for the Newton I power plant.

The CIPS Decision

In January 1973, Sargent & Lundy, a Chicago based architectural and engineering firm which designed the Newton plant, sent specifications for a scrubber system to seven major FGD manufacturers. After bids came in, Sargent & Lundy applied their standard selection criteria and recommended one of the proposals that July. Almost a year later, Sargent & Lundy asked that the original seven proposals be updated, and in addition that three new vendors submit proposals. In January 1975, after exhaustive review,

a lime scrubber by Chemico was recommended. Heeding this advice, CIPS made an agreement with Chemico that April to do preliminary engineering and cost analysis on a lime FGD system for the Newton plant.

In the months that followed however, CIPS engineers became increasingly skeptical about the reliability of a lime FGD system in conjunction with boilers burning high sulfur, high chloride Illinois coal. Through intensive reading, field trips, and consultation with other utilities, they became convinced that a lime/limestone system was unacceptable. Although the preliminary work by Chemico was very good, CIPS engineers advised senior management that a lime FGD system would not provide reliable pollution control on a continual basis. On this advice, CIPS management terminated the agreement with Chemico. A short time later they initiated a new agreement with Buell Envirotech to engineer a double alkali FGD system.

To develop the DAFGD system for CIPS, Buell conducted experimental work at the 1 MW Gadsby Pilot Plant in Salt Lake City, a facility where Buell frequently did joint double alkali R&D with Utah Power and Light. Tests were made monitoring DAFGD performance with chlorine-injected flue gases, a procedure used to simulate the high chloride Illinois coals. Results of this work, together with detail descriptions, data, cost estimates, and diagrams of the scrubber for the Newton plant, is included in the second half of Exhibit A-2. Note particularly the section in Exhibit A-2 on the spray tower precooler, necessary in high chloride double alkali design to maintain recovery of sodium from the filter cake. This parameter is critical because sodium is an expensive ingredient in the process.

On June 1, 1976, CIPS awarded the contract for the Newton I DAFGD system to Buell Envirotech. One month later site construction began, and CIPS was committed to double alkali. The scheduled completion date was July, 1978.

Subpart D—Standards of Performance for Fossil-Fuel-Fired Steam Generators for Which Construction Is Commenced After August 17, 1971

§ 60.40 Applicability and designation of affected facility.

(a) The affected facilities to which the provisions of this subpart apply are:

(1) Each fossil-fuel-fired steam generating unit of more than 73 megawatts heat input rate (250 million Btu per hour).

(2) Each fossil-fuel and wood-residue-fired steam generating unit capable of firing fossil fuel at a heat input rate of more than 73 megawatts (250 million Btu per hour).

(b) Any change to an existing fossil-fuel-fired steam generating unit to accommodate the use of combustible materials, other than fossil fuels as defined in this subpart, shall not bring that unit under the applicability of this subpart.

(c) Except as provided in paragraph (d) of this section, any facility under paragraph (a) of this section that commenced construction or modification after August 17, 1971, is subject to the requirements of this subpart.

(d) The requirements of §§ 60.44(a)(4), (a)(5), (b) and (d), and 60.45(f)(4)(vi) are applicable to lignite-fired steam generating units that commenced construction or modification after December 22, 1976.

(e) Any facility covered under Subpart Da is not covered under this Subpart.

(Secs. 111, 114, and 301(a), Clean Air Act; Sec. 4(a) of Pub. L. 91-604, 84 Stat. 1683; sec. 2 of Pub. L. 90-148, 81 Stat. 504 (42 U.S.C. 1857c-6, 1857g(a), 7411, 7414, and 7601))

[42 FR 37936, July 25, 1977, as amended at 43 FR 9278, Mar. 7, 1978; 44 FR 33612, June 17, 1979]

§ 60.41 Definitions.

As used in this subpart, all terms not defined herein shall have the meaning given them in the Act, and in Subpart A of this part.

(a) "Fossil-fuel fired steam generating unit" means a furnace or boiler used in the process of burning fossil fuel for the purpose of producing steam by heat transfer.

(b) "Fossil fuel" means natural gas, petroleum, coal, and any form of solid, liquid, or gaseous fuel derived from such materials for the purpose of creating useful heat.

(c) "Coal refuse" means waste-products of coal mining, cleaning, and coal preparation operations (e.g. culm, gob, etc.) containing coal, matrix material, clay, and other organic and inorganic material.

(d) "Fossil fuel and wood residue-fired steam generating unit" means a furnace or boiler used in the process of burning fossil fuel and wood residue for the purpose of producing steam by heat transfer.

(e) "Wood residue" means bark, sawdust, slabs, chips, shavings, mill trim, and other wood products derived from wood processing and forest management operations.

(f) "Coal" means all solid fuels classified as anthracite, bituminous, subbituminous, or lignite by the American Society for Testing Material. Designation D 388-66.

(Secs. 111 and 301(a), Clean air Act, as amended (42 U.S.C. 7411, 7414, and 7601))

[39 FR 20791, June 14, 1974, as amended at 40 FR 2803, Jan. 16, 1975; 41 FR 51398, Nov. 22, 1976; 43 FR 9278, Mar. 7, 1978]

§ 60.43 Standard for sulfur dioxide.

(a) On and after the date on which the performance test required to be conducted by § 60.8 is completed, no owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility any gases which contain sulfur dioxide in excess of:

(1) 340 nanograms per joule heat input (0.80 lb per million Btu) derived from liquid fossil fuel or liquid fossil fuel and wood residue.

(2) 520 nanograms per joule heat input (1.2 lb per million Btu) derived from solid fossil fuel or solid fossil fuel and wood residue.

(b) When different fossil fuels are burned simultaneously in any combination, the applicable standard (in ng/J) shall be determined by proration using the following formula:

$$PS_{SO_2} = [y(340) + z(520)]/y+z$$

where:

PS_{SO_2} is the prorated standard for sulfur dioxide when burning different fuels simultaneously, in nanograms per joule heat input derived from all fossil fuels fired or from all fossil fuels and wood residue fired,

y is the percentage of total heat input derived from liquid fossil fuel, and

z is the percentage of total heat input derived from solid fossil fuel.

(c) Compliance shall be based on the total heat input from all fossil fuels burned, including gaseous fuels.

[39 FR 20792, June 14, 1974, as amended at 41 FR 51398, Nov. 22, 1976]

Exhibit A-1

Excerpts from EPA Emissions Standards

Ref: 1981 U.S. Code of Federal Regulations,

Title 40, Chap. 1, Part 60

ZERO-EFFLUENT THROWAWAY SO_2 SYSTEM DESIGN FOR HIGH-CHLORIDE, HIGH-SULFUR COAL

WILLIAM J. HOLHUT
Construction Engineering Supervisor

and

TED R. NELSON
Flue Gas Systems Engineer
Central Illinois Public Service Company
Springfield

WILLIAM ELLISON
Marketing Manager, SO_2 Systems
Buell-Envirotech
Lebanon, Pennsylvania

JAMES H. WILHELM
Senior Research Engineer
Eimco BSP Division
Envirotech Corporation
Salt Lake City

INTRODUCTION

The body of information presented in this paper is directed to those individuals concerned with development and commercial application of boiler flue gas desulfurization (FGD) technology that will meet utilities' operating reliability and environmental pollution control objectives.

Construction of new electric generating units requires provision for control and disposal of major quantities of fly ash particulate matter and sulfur dioxide emissions without reducing power plant availability or creating further pollution problems due to discharge of scrubbing liquid effluent and waste products.

Nonsulfur-recovering SO_2 scrubbing processes, utilizing common lime or limestone to convert the sulfur oxides catch to a throwaway solid waste, continue to offer utilities the most economical and practical means of meeting SO_2 removal objectives when firing medium- to high-sulfur coal. Such waste-throwaway FGD systems have lower installed cost and utilize liquids/solids treatment facilities of standard mechanical design, permitting routine operation by normal utilities personnel. Moreover, as developed in this paper, conversion of collected SO_2 to a calcium/sulfur waste of solid form provides an effective and economical means, not available to designers of sulfur-recovery-type systems, for assimilating required system liquid purge as a residual surface-moisture in a disposable dewatered solid-waste filter cake. However, commercial and experimental experience with lime/limestone slurry FGD now indicates that unless adequate process design means are devised, serious oxidation-related process, maintenance, and system reliability problems may be expected due to intensification of gypsum scaling by fired-coal tramp components, particularly sodium chloride and heavy metals ultimately collected in the SO_2 scrubber as hydrogen chloride, metal vapors, or particulate. Chemical scaling problems have prevented operation of almost all of these FGD installations in the zero-effluent (closed loop) mode which is generally required of SO_2 waste disposal systems at eastern United States sites. Demonstration of adequate waste water management in slurry-scrubbing-type FGD systems has been further compromised by the frequent use of ponds for SO_2 sludge disposal and the resulting greater potential for surface and ground water pollution.

This paper reviews a commercial

waste-throwaway FGD system-design advancement adapting the concentrated-active-alkali mode double-alkali process for a high-chloride Illinois coal-fired 575-MW power plant installation at Newton, Illinois, which requires closed liquid-loop operation with zero liquid-effluent outfall. Scale prevention is achieved through segregated collection from the flue gas of coal tramp-components and by suppression of scrubbing liquid calcium-ion concentration. This high-availability gas cleaning process design, scheduled for late 1977 startup, is believed to be broadly applicable to high-chloride bituminous coal-fired power plants requiring stringent management of solid waste and waste water.

IMPACT OF COAL TRAMP-COMPONENTS ON FGD DESIGN AND OPERATION

Direct Lime/Limestone Slurry Scrubbing

General Operation—In SO_2 slurry scrubbing, the hot boiler flue gas directly contacts a slurry of calcium sulfite and calcium sulfate reaction product containing lime or finely ground limestone. Sulfur oxides are absorbed and converted to bisulfite and sulfate ions. The scrubber slurry then flows to an outlet delay tank where collected sulfur oxides are postprecipitated as calcium sulfite and sulfate by addition of the fresh lime or limestone. The bulk of this treated slurry is pumped back to the scrubber to remove more SO_2 while a purge stream is bled to a thickener for waste-solids dewatering. Thickener overflow is recycled to the scrubber system. Thickener-underflow slurry solids are disposed of in a waste pond or are dewatered to a cake, typically in a rotary vacuum filter, prior to landfill disposal.

Key Process Problems—A 1975 United States Senate Public Works Committee report[1] authored by the Commission on Natural Resources, et al., gives an updated review of slurry scrubbing experience emphasizing the major operating problem: control of gypsum scaling. Until recently, field data extending back 35 years to early work in England have indicated that the most promising method for scale control is to closely limit the degree of calcium sulfate supersaturation of the scrubbing-slurry liquid phase. However, the Commission judges that it is preferable if possible to operate in the unsaturated calcium sulfate mode of operation disclosed in 1974.[2] This promising process technique coprecipitates calcium sulfite and sulfate reaction product from slurry liquid saturated in calcium sulfite and unsaturated in calcium sulfate and is favored by low sulfite-to-sulfate oxidation tendencies and presence of buffering magnesium ions. Calcium sulfate can be coprecipitated with the principal sulfite precipitate up to a sulfate/sulfite mole ratio of only roughly 0.20. Accordingly, unsaturated conditions can be maintained only at the comparatively low sulfite oxidation rates achievable in high SO_2/O_2 ratio emission sources such as pulverized bituminous-coal-fired boilers. Slack[3] refers to mist eliminators plugging, related to gypsum scaling, and to heavy maintenance, which has hindered fullest acceptance of slurry scrubbing system technology.

Tramp-Component Effects—The 1975 Commission report to the Senate indicates that:

1. Eastern United States utilities FGD installations now generally call for process operation in closed loop, e.g., zero liquid-effluent outfall.
2. The dry removal of fly ash in an electrostatic precipitator upstream of the FGD system can be expected to help to limit sulfite oxidation caused by oxidation-catalyzing metal components.

Exhibit A-2 Reprinted from Proceedings of the American Power Conference, Vol. 38, 1976. Reproduced by permission of the American Power Conference and Mr. William J. Holhut

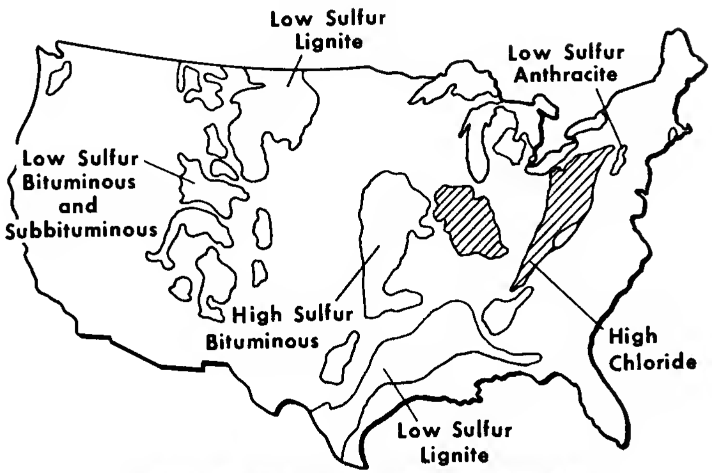

Fig. 1—Eastern high chloride coal areas. (Source: U.S. Geological Survey.)

3. Presence of chloride ions makes it more difficult to operate unsaturated in calcium sulfate, particularly in limestone scrubbing. Chlorides counteract the favorable buffering effect of magnesium. Moreover, at coal-chloride concentration above 0.04 percent by weight, system reliability cannot presently be assured in designing the slurry-type FGD processes in the unsaturated mode for closed-loop operation.
4. The only recent successfully commercial slurry-scrubbing operations in medium- to high-sulfur bituminous coal service have been in the unsaturated mode. Of these, only the lime slurry installation at Louisville Gas and Electric Company's Paddy's Run Station, a low-chloride application, is closed loop.

Tramp-Component Concentrations — The critical 0.04 percent coal-chloride level specified above is one order of magnitude lower than the industry's earlier high-chloride criterion,[4] which related to boiler furnace deposition tendencies. Major reserves of Eastern bituminous coal (Fig. 1) substantially exceed the new reference level. Illinois coals (Fig 2) have especially high chloride content calling for special attention to potential design complications in liquid-effluent and gypsum-scale control.

Double-Alkali Scrubbing

Operation and Advantages—Double or dual-alkali systems utilize a comparatively clear scrubbing liquid containing highly water-soluble alkali, usually sodium hydroxide and/or sulfite, that forms highly soluble sulfite/sulfate reaction products in absorbing SO_2. A portion of the recirculating scrubbing liquid is continuously bled off and mixed with lime in reaction tanks (process causticizers) external of this SO_2 scrubber circuit, thereafter converting the dissolved sulfur-

oxides catch together with any suspended solids that are present to a disposable solid waste after postprecipitation, thickening, vacuum filtration and waste filter-cake washing. This postprecipitation process chemically regenerates the liquid phase of the continuous bleed stream which is returned from the thickener overflow to the scrubber to maintain continuous SO_2 removal from the flue gas. This is illustrated in the right-hand portion of Fig. 3 showing the scrubber and its interconnected auxiliary process equipment operating in the concentrated-active-alkali mode of double-alkali operation.

The concentrated mode maintains a high concentration of sodium sulfite alkali in the regenerated liquor, typically 0.5 molar or greater, depressing dissolved calcium concentration to approximately 50 ppm or less due to the very low aqueous solubility of calcium sulfite, the major postprecipitate. This gives reliable prevention of gypsum scaling without need for chloride-sensitive magnesium buffering or other special provisions for scale control required in slurry-scrubbing FGD. The high dissolved alkali strength also minimizes the size of the postprecipitation system process equipment and permits operation of the SO_2 scrubber at very high SO_2 removal efficiency with economical liquid-to-gas ratios of less than 10 gallons per thousand cubic feet of scrubbed gas. Since the concentrated double-alkali process operates unsaturated in calcium sulfate, the filter-cake solids are a coprecipitate of calcium sulfate in calcium sulfite, the bulk of the precipitate being sulfite. For discussion of detailed aspects of double-alkali process operation see Kaplan's recent paper.[5] The double-alkali process is an important technology advancement due to its elimination of major scaling, fouling, erosion and maintenance problems in a desirable closed-loop operating sequence. At the same time it can be seen to be a logical extension of slurry scrubbing technology,[6] utilizing valuable mechanical design experience gained in these earlier systems.

Fig. 2—Illinois coal chloride pattern. Isochlors indicate percent chlorine in coal. (Source: Illinois Geological Survey.)

Tramp-Component Effects—Tramp material collected in the double-alkali SO_2 scrubber does not detract from scale control effectiveness in the concentrated mode, which is maintained under all conditions due solely to the "calcium sulfite liquor softening" achieved in the double-alkali postprecipitation step. However, there are significant adverse effects of substantial entry of chlorides and tramp metals on the double-alkali process as follows:

1. All hydrogen chloride absorbed in the SO_2 scrubber ties up with sodium as dissolved sodium chloride,

Exhibit A-2, cont.

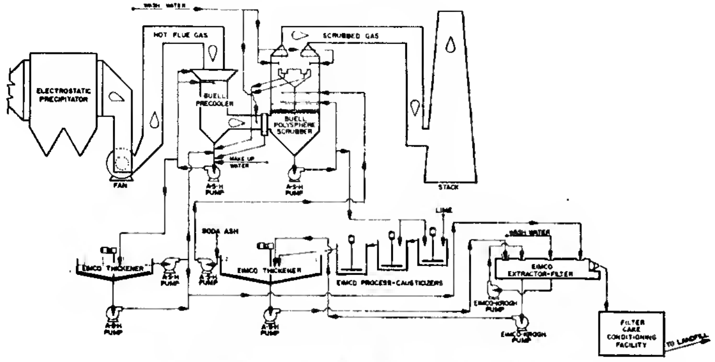

Fig. 3—Duplex double-alkali system (Newton Station).

which is completely lost in the filter cake surface moisture despite provisions for washing of cake for sodium recovery.

2. As sulfate ion production is increased due to oxidation-catalyzing effects of tramp metals, dissolved sodium sulfate losses in cake surface moisture increase.
3. Increased concentrations of sodium chloride and sodium sulfate in double-alkali scrubbing liquor resulting from chloride and tramp-metal effects increase tendencies for sodium sulfate salting-out in cold weather operation. Increased dissolved solids content of the liquor also increases the impact of scrubber carryover on the total solids emission from the stack.
4. Increased liquor-chloride concentration may increase corrosion effects.

HIGH-CHLORIDE DOUBLE-ALKALI DESIGN

General

In establishing an FGD flow-sheet arrangement to meet the stringent zero-effluent requirements of the Newton Station with capability of firing indigenous high-chloride high-sulfur coals of wide ranging characteristics, the following system strategy has been applied:

1. Utilize the concentrated double-alkali process to gain stable control of scaling chemistry.
2. Limit the impact of fly ash components on double-alkali chemistry and reliability by dry collection of fly ash with a high-efficiency electrostatic precipitator.
3. Minimize the impact of chlorides on double-alkali process operation and costs by utilizing a spray-tower-type flue-gas precooler, operating without alkaline feed, to selectively absorb and isolate gaseous hydrogen chloride, the major reaction product originating from the combustion of chlorides in the fired coal.
4. Impregnate-wash the fresh-water-washed filter cake from the double-alkali SO_2 removal system with a purge from the precooler scrub loop to achieve continuous disposal of the precooler catch without discharge of liquid effluent outfall.

Wet Process System Design

Refer to Fig. 3, which gives a general illustration of this new multistage (duplex) zero-effluent flue-gas cleaning process for high-sulfur bituminous coal.

Principal criteria in the application of equipment and process technology include the following:

Electrostatic Precipitator — Collection of over 99 percent of the fly ash contained in the boiler flue gas serves to limit the quantity of fly ash impacting on the wet scrubbing system. At the same time a substantial bulk source of finely divided fly ash is made available for mixing with the waste filter cake prior to landfill disposal of both waste products if needed to improve compactability and final density of the cake and the structural properties of the completed landfill.

Precooler—Due to the very low hydrogen chloride vapor pressure exerted by depressed-pH aqueous solutions of hydrogen chloride, even at hydrochloric acid strengths as high as 2 to 3 percent, a high-velocity cocurrent spray tower may be utilized for gas precooling and absorption of at least 90 percent of the chloride gas. Recent flue-gas trace element studies by research organizations[7,8] indicate that some of the metallic trace-elements exist partly in the vapor phase during the dry gas cleaning stage. The spray-tower-type precooler can be expected to efficiently condense and remove such vapors, minimizing their extraneous effect on FGD process chemistry. A high-velocity vertical impingement-vane mist eliminator in the horizontal gas outlet duct from the precooler limits the quantity of acid-liquor carryover into the SO_2 scrubber so as to maintain efficient isolation of collected chlorides. The fly ash thickener shown purges and clarifies precooler liquor and prevents collected fly ash from forming significant concentrations of abrasive slurry solids in the recirculating liquor.

SO_2 Scrubber—SO_2 emissions are reduced to less than 200 ppm utilizing a countercurrent two-tray-stage mobile-ball bed scrubber operating at 500 feet per minute design gas velocity with a liquid/gas flow ratio of less than 10 gallons recirculated sodium liquor per thousand cubic feet. SO_2 removal may be maximized by introducing regenerated liquor as a final spray-absorption stage as shown. A vertical mist eliminator efficiently controls sodium liquor carryover to limit the stack emission of chemical-solids. The eliminator vanes are intermittently washed with service water, which may then be discharged to the precooler loop to maintain a favorable water-balance in the sodium loop.

Vacuum Filter — After postprecipitation and thickening of the sulfur oxides collected in the mobile-ball scrubber, the solids are dewatered and fresh-water washed in a top-loading horizontal-belt-type extractor filter described by Cornell.[9] The unique geometry of this novel process equipment permits countercurrent multistage washing of the raw formed cake with limited quantities of service water, achieving over 80 percent recovery of the cake sodium in the vacuum filtrate which is recycled to the sodium loop for reuse. Again referring to Fig. 3, a liquid purge stream from the precooler loop, containing collected chlorides, residual fly ash, and trace elements, flows to a lime-neutralization tank (not shown) and then is utilized as the wash medium for a final "cake-impregnation wash." It is thereby discarded as surface moisture in the final waste cake, replacing original surface moisture in the fresh-water-washed cake without discharge of liquid effluent.

Exhibit A-2, cont.

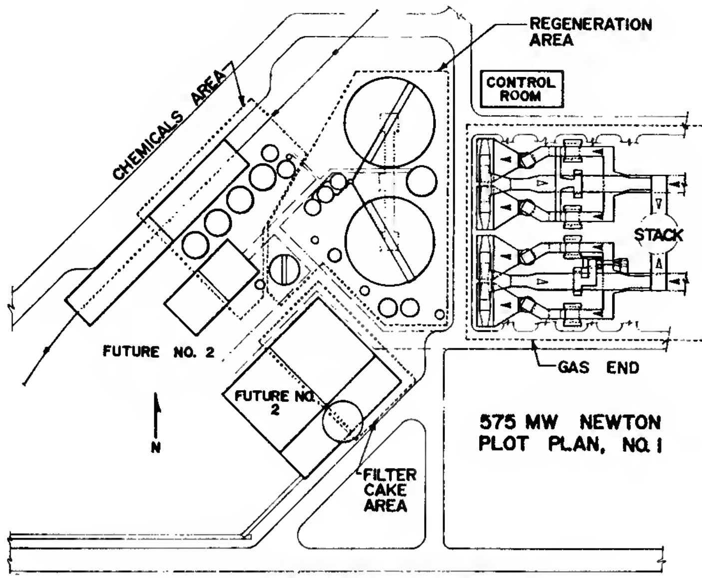

Fig. 4—Newton double-alkali system arrangement.

NEWTON STATION 575-MW INSTALLATION

Plant Design

Newton Station Unit No. 1, Newton, Illinois, will utilize a drum-type boiler manufactured by Combustion Engineering, Inc., designed for a maximum steam generating capacity of 4,158,619 lb/h at 2620 psig and 1005 F at the steam outlet connection. Design excess air in the boiler is 22 percent with flue gas flow to the scrubbing system totalling 6,615,000 lb/b. The boiler design includes two parallel-operated induced-draft fans with discharge into a common plenum which can feed raw gas to the FGD system or to the stack. The boiler is tangentially fired with coal from bowl-type pulverizing mills utilizing high-sulfur Illinois bituminous coals from any of several local sources.

The double-alkali system is conservatively designed for a boiler heat release of 5.5×10^9 Btu/b firing bituminous coal containing 4.0 percent sulfur and 0.2 percent chloride of 10,900 Btu/lb heating value.

A description of this 575-MW FGD system including some design details has been given by Bloss, et al.[10] The overall plot arrangement is shown in Fig. 4. Location of flue-gas handling components is detailed in Fig. 5.

FGD Facilities List

The duplex-type double-alkali system, which is being built to serve Unit 1, will include the following principal equipment and facilities:

1. Four booster fans.
2. Ductwork, including the plenum leading to the four booster fans, also including isolation dampers for each fan.
3. Isolation dampers in the boiler ductwork to isolate the I.D. fans from the stack.
4. Four precooler spray towers, including mist eliminators.
5. Ductwork from the booster fans to the precoolers.
6. Four mobile-ball gas scrubbers, including mist eliminators.
7. Ductwork from the scrubbers connecting them to two plenums, each of which is common to two scrubbers. This ductwork will include outlet isolation dampers for each scrubber.
8. All ductwork to exhaust the scrubber system to the stack utilizing two experimental reheat techniques.
9. Lime unloading and handling system including:
   a. Rail and truck unloading facilities for pebble or granular lime.
   b. Four lime storage silos.
   c. Lime feeding and ball-mill-slaking facilities.
   d. Lime feeding and slaking building.
10. Soda ash facilities including:
    a. Rail and truck unloading.
    b. Two soda ash storage silos.
    c. Soda ash feeding and dissolving equipment.
11. Provision for material off-loading includes a train shed of approximately 250-foot length which will accommodate four cars as well as material-handling equipment to unload two cars at one time from a total of six hoppers. The material off-loading facility is able to handle trucks which may or may not have self-contained unloading auxiliaries.
12. Two 100-ft diameter thickeners for the double-alkali postprecipitation system with concrete bottoms and access to bottom discharge cone using tunnel.
13. One 50-ft diameter thickener for the precooler loop, constructed of coated steel and elevated above grade.
14. Three horizontal Eimco-Extractor filters for dewatering and multi-stage washing of double-alkali thickener underflow with associated equipment including vacuum pumps, filtrate receivers, filtrate pumps, and moisture traps. A building to house the filters and auxiliaries is included.
15. A control and maintenance building.
16. Flocculant addition systems for the thickeners.

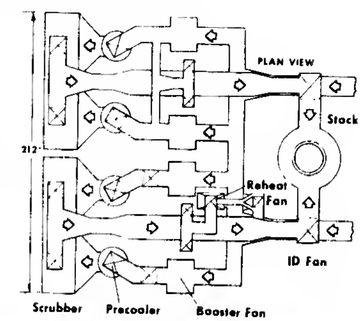

Fig. 5—Plan of Newton wet scrubbing area.

Cost Projections

The project is currently in the design-engineering and procurement phase and final installation and operating costs have not yet been assembled. However, our best current estimate of erected costs, and of materials, utility and manpower requirements have been combined to establish preliminary FGD economics as

Exhibit A-2, cont.

TABLE I
575-MEGAWATT NEWTON UNIT 1
ANNUAL COSTS OF DOUBLE-ALKALI SYSTEM, 95% SO_2 REMOVAL

- Life of Boilar Plant and FGD System: 30 years
- Boilar On-Staam Time: Equivalent of 6132 h/yr @ Full Load, (70% Load Factor)
- Coal Burned: 1,550,000 tons/year, 10,900 Btu/lb, 4% S, 0.2% Cl
- Estimated Capital Investmant: $40,000,000
- Full Load Heat Ralease: 5500 × 10^6 Btu/h
- Stack Exit Tamperature: 154 F

	Annual Quantity	Unit Cost, $	Total Annual Cost, $
DIRECT COSTS			
Quicklima (93% Available CaO)	115,000 tons	$35/ton	$4,025,000
Soda Ash (98% Na_2CO_3)	3,800 tons	80/ton	304,000
Staam, 125 psig	153,000 M lb	1.20/M lb	184,000
Service Water	310,000 M gal	0.30/M gal	93,000
Electric Powar	80 × 10^6 kWh	0.012/kWh	960,000
Oparating Labor and Supervision	43,000 Man-hours	8.00/M-H	344,000
Maintanance: Labor and Material, (.03 × $40,000,000)			1,200,000
Total Direct Costs:			$7,110,000
INDIRECT COSTS			
Capital Charges (.14 × $40,000,00)			$5,600,000
Plant Overhead			680,000
Administrativa Ovarhaad, 10% of Operating Labor			34,400
Total Direct Costs:			6,314,000
TOTAL COSTS, Direct and Indirect			$13,424,400

summarized in *Table I*. Note that the estimated annual cost of ownership and operation basis 70 percent load factor is in excess of $13,000,000. Unit-cost of ownership and operation of the system has been calculated and may be defined in alternative units as follows: $8.66/ton coal fired; 3.81 mils/kWh generated; 39.8¢/MM Btu heat input; or $240/ton sulfur removed.

CONCLUSION

Scrubbing of sulfur dioxide from boiler flue gas has been a major problem for the utilities industry due to its overall impact on power plant operation and reliability of electric generation. Design complexities may be substantially increased by coal tramp-components collected simultaneously with SO_2 in the SO_2 scrubber. Accordingly, we conclude that major growth in development and utilization of substantial reserves of high-chloride medium- to high-sulfur bituminous coal in Illinois, Pennsylvania, West Virginia and other eastern locations will depend on the utilization of advanced FGD technology that can control the adverse impact of halogens and other accompanying tramp-components on FGD process operation. The 575-MW installation at CIPS' new Newton Station, the largest waste-throwaway FGD system of the double-alkali type applied at any power plant to date, is a unique installation of this type designed to achieve zero-effluent closed-liquid-loop performance and high availability in this high chloride service. Key system operations include (1) a high-efficiency electrostatic precipitator; (2) multiloop wet scrubbing for isolation of collected tramp components from SO_2; (3) lime post-precipitation of SO_2 absorbed in a sodium-sulfite-rich scruh liquor; using (4) a liquid/solids posttreatment system designed to assimilate all liquid wastes as surface moisture in dewatered filter-cake waste-solids. Utilization of conventional gas cleaning, waste-water treatment and chemical process equipment and unit operations in this innovative design provides added assurance of successful commercial performance of this capacity scaleup from pilot/demonstration plant operation.

REFERENCES

1. "Air Quality and Stationary Source Emission Control, A Report by the Commission on Natural Resources, National Academy of Sciences, National Academy of Engineering, National Research Council, Prepared for the Committee on Public Works, United States Senate, Pursuant to S. Res. 135 Approved August 2, 1973." 94th Congress, Serial No. 94-4, March 1975, 389, 390, 392, 395, 397, 399, 411, and 425. Washington, D. C.: U.S. Govt. Print. Office, 1975.
2. Borgwardt, R. H., "EPA/RTP Pilot Studies Related to Unsaturated Operation of Lime and Limestone Scrubbers," *Proc. Symp. Flue Gas Desulfurization, Atlanta, November 4-7, 1974*, **PB 242,572 (EPA-650/2-74-126-a)**, 225-40. Springfield, Va.: National Technical Information Service, 1974.
3. Slack, A. V., "1975 Scrubber Report, Technology Still Undergoing Labor Pains," *Elec. World*, **184**, 38, 42 (1975) December 15.
4. Reid, W. T., *External Corrosion and Deposits, Boilers and Gas Turbines*. 140. New York: American Elsevier, 1971.
5. Kaplan, N., "Introduction to Double Alkali Flue Gas Desulfurization Technology," Paper presented at the EPA Flue Gas Desulfurization Symposium, New Orleans, March 8-11, 1976.
6. Albrecht, P. F. and Lieberman, J. A., "Reliability of Flue Gas Desulfurization Systems," *Power Eng.*, **79**, 58 (1975) June.
7. Meserole, F. B., *et al.*, "Coal Fired Power Plant Trace Element Study, Volume I, A Three Station Comparison," Prepared for U.S. Environmental Protection Agency by Radian Corp., Austin, Tex., EPA Contract No. 68-01-2663, 48, September 1975.
8. Klein, D. H., *et al.*, "Pathways of Thirty-Seven Trace Elements Through Coal-Fired Power Plant," *Environ. Sci. Technol.*, **9**, 978 (1975) October.
9. Cornell, C. F., "Liquid-Solids Separation in Air Pollutant Removal Systems," *Preprint* **2363** presented at the American Society of Civil Engineers Annual and National Environmental Engineering Convention, Kansas City, October 21-25, 1974.
10. Bloss, H. E., Wilhelm, J. and Holhut, W. J., "The Buell Double-Alkali SO_2 Control Process," Paper presented at the EPA Flue Gas Desulfurization Symposium, New Orleans, March 8-11, 1976.

PREPARED DISCUSSION

RICHARD B. ENGDAHL
Senior Researcher
Battelle-Columbus Laboratories
Columbus, Ohio

This paper is a welcome contribution to the emerging technology of flue-gas desulfurization. It offers an interesting and, hopefully, practical approach to the very real but largely ignored problem of coal ash constituents and their uncertain effect on the chemistry of scrubbers. The real need for both a high-efficiency fly ash precipitator plus a spray-tower precooler to absorb the hydrogen chloride may not yet be proven but it is a prudent choice and on the

Exhibit A-2, cont.

safe side and, hopefully, will help to achieve a more controllable scrubber cbemistry.

The double-alkali principle is gaining increasing favor as the various small installations now operating on coal demonstrate their freedom from the scaling which still forms in most lime or limestone systems, particularly when these are required to operate closed loop on high-sulfur coals. Also, if the precleaning of the Autbors' system is really effective in suppressing coal ash constituents before they can reach the scrubber, the formation of sodium sulfate should be minimized, which will be an economy as well as reducing tbe amount of potential leachant discharged with the sludge. However, the addition to tbe sludge of chlorides from the precooler will add somewhat to the problem of leaching.

A caution sbould be retained about the emerging trend to double-alkali systems. All of the promising double-alkali plants now operating in the United States are very small. The larger ones in Japan are on oil-fired boilers. The Newton Plant will be the first large-scale attempt to operate on high-sulfur, high-ash coal. Many other metbods have seemed fine at small scale but wben translated to the unusually large sizes of equipment required by utility boilers, have encountered very difficult problems involving poor mixing and nonuniform flow distribution. Until this promising plant is well demonstrated over a reasonable time, the well-known but not easily predictable uncertainties involved in scaleup to very large sizes need to be kept in mind.

Exhibit A-2, cont.

PART B: STARTING UP NEWTON I

Background

There is a version of Murphy's Law which could be applied to many engineering construction projects--everything will take longer and cost more than you expected. Such was the case with CIPS and their double alkali flue gas desulfurization system. Because the scrubber was a first-of-its-kind application of double alkali on such a large scale, technical problems arose during construction. Already by May 1977, CIPS knew the DAFGD system would not come on line until late 1979, a year and a half after the original target date. Cost estimates had suddenly doubled to over $100 million.

The generating unit itself was due to come on line in late 1977, and CIPS concluded that if it postponed startup of the power plant while waiting for the DAFGD system to be completed, it would be risking power shortages within its service area.

CIPS then decided to begin generating power in Newton I even though the scrubber was not operable. However, if CIPS burned high sulfur coal unscrubbed, SO_2 emissions from Newton I were expected to be on the order of 4.6 $lb/10^6BTU$, a clear violation of the NSPS. Thus CIPS petitioned the Illinois Pollution Control Board for a variance to allow CIPS to burn high sulfur coal without any FGD for 23 months, claiming that such a move was necessary only because of unanticipated delays in the completion of the DAFGD system. They presented results of modelling efforts to show that even though uncontrolled SO_2 emissions from the plant violated the NSPS, they would not violate ambient air quality standards for the region.

The Illinois Pollution Control Board granted the variance on September 1, 1977, concluding that the construction delays that CIPS was experiencing were reasonable considering the lack of commercial experience in building DAFGD scrubbers. With the requirement for meeting NSPS waived, Newton I began operation on September 10, 1977. However, the startup of Newton I triggered a confrontation between CIPS and the U.S. Environmental Protection Agency.

The Environmental Engineer

Bruce Varner is an environmental engineer with the EPA Region V office in Chicago. He worked closely with the EPA lawyers and met with representatives of CIPS

during the conflict described in the following sections between EPA and CIPS over the operation of the Newton I plant. Bruce received his B.S. and M.S. degrees in chemical engineering from Notre Dame in 1965 and 1966. He is a registered professional engineer in North Carolina and had worked for EPA since 1972. He joined the Chicago office in 1976 where he is the principal engineer responsible for assuring compliance with emission standards for hazardous air pollutants and the federal New Source Performance Standards (NSPS).

Early Interactions Between EPA and CIPS

EPA and CIPS started discussing plans for the Newton I DAFGD system as early as 1975 when CIPS decided to switch to the double alkali approach rather than proceed with a lime scrubber. At that time, CIPS proposed that they be allowed to install the DAFGD system on a modular basis. EPA turned down that request, insisting that a complete FGD system had to be in place when Newton I became operational. Also in 1975, CIPS applied to EPA for funding which would allow the Newton I plant to serve as a demonstration of the DAFGD technology, but the CIPS request for EPA demonstration funding lost out to a similar request by Louisville Gas & Electric, whose proposed DAFGD system was about half the size as CIPS. These events occurred before Bruce Varner had joined the staff of EPA's office in Chicago. However they were part of the background for the situation in which he found himself shortly after starting his job in Chicago.

Another key development during the 1975-1977 period was Congressional deliberations on amendments to the Clean Air Act; those amendments were enacted into law on August 7, 1977 just one month prior to the startup of the Newton I plant. Among those amendments was Section 111(j) which would allow EPA to waive some of the emission restrictions on power plants which used a pollution control system based on "innovative technology". This new language was to become the basis for the court battle between EPA and CIPS which is described in Parts C and D of this case. Interestingly enough, the newly enacted Clean Air Act amendments included language which gave Louisville Gas & Electric extra time to install their DAFGD system. CIPS was not given a similar break.

The Conflict Builds

On August 4, 1977 after EPA learned that CIPS was planning to start the Newton I plant without any scrubber, EPA issued an anticipatory Notice of Violation. Several

weeks later, on August 24, representative of EPA and CIPS met to discuss the anticipated violation. Bruce Varner attended that meeting and brought with him an engineering statement which showed his calculations of the extent of excess annual SO_2 emission to be expected from operation of Newton I without the scrubber. Bruce's engineering statement is reproduced as Exhibit B-1.

During this period, EPA continued to press CIPS to use low sulfur coal as an interim fuel until the DAFGD system became operational. In several previous cases involving other utilities, EPA had managed to work out similar interim arrangements. One of the reasons CIPS was reluctant to burn low sulfur coal in Newton I as an interim measure was that the coal pulverizer mill at the plant was designed for coal with a grindability index of 55 whereas low-sulfur coal has a grindability index of 36 to 40.* CIPS also claimed that additional ash slagging from the low sulfur coal would be detrimental to the turbine. Further, according to CIPS, use of low sulfur coal would lead to a substantial drop in the generating capacity of the plant.

Bruce Varner and EPA lawyers met again with CIPS representatives in October 1977 at which time CIPS asked for guidance in filing for an innovative technology waiver under Section 111(j) of the recently enacted amendments to the Clean Air Act. At the same meeting, CIPS informed Bruce and the other EPA staff that the Newton I plant had been fired up on September 10. Faced with the fact that Newton I was now operating with no SO_2 controls, Bruce and his colleagues proceeded to develop a course of action for EPA.

---

* Some coals are harder and hence more difficult to pulverize than others. The grindability index of a coal is the relative hardness of that coal compared to a standard coal whose grindability is established as 100. Grindability index can be established in a test described in ASTM Standard D 409.

ENGINEERING STATEMENT

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY (CIPS),

NEWTON, ILLINDIS - BOILER NO. 1

113 CONFERENCE - CHICAGO, ILLINOIS 8/24/77

THE SPECIFIC REGULATIONS CITED IN THE NOTICE OF VIOLATIONS ARE THE FEDERAL STANDARDS OF PERFORMANCE FOR NEW STATIONARY SOURCES, 40 CFR §6D.43(a)(2); AND THE ILLINOIS STATE IMPLEMENTATION PLAN, ILLINOIS POLLUTION CONTROL BOARD RULES ANO REGULATIONS, CHAPTER 2, PART II, RULE 204(a)(1). BOTH LIMIT SULFUR DIOXIDE (SO_2) EMISSIONS FROM NEW FOSSIL FUEL-FIRED STEAM GENERATDRS THAT BURN SDLID FUEL ANO HAVE HEAT INPUTS OVER 25D MILLION BTU PER HOUR TO 1.2 POUNOS PER MILLION BTU HEAT INPUT.

ON MAY 31, 1977, THE COMPANY FILEO A PETITION FOR VARIANCE FROM SULFUR OIOXIOE EMISSION REGULATIONS WITH THE ILLINOIS POLLUTION CONTROL BOARO. THIS PETITION STATEO THAT CIPS NEWTDN BOILER NO. 1 HAS A RATEO HEAT INPUT OF 53D0 MILLION BTU PER HOUR; THAT IT WILL BURN 1.6 MILLION TONS PER YEAR OF COAL WITH A SULFUR CONTENT OF 2.8 PERCENT ANO A HEATING VALUE OF 11,500 BTU PER POUNO; ANO THAT IT IS ANTICIPATEO THAT IT WILL OPERATE FROM OECEMBER 1, 1977, TO NOVEMBER 3, 1979, WITHOUT OPERABLE SO_2 CONTROL EQUIPMENT.

BASEO UPON THE ABOVE SULFUR CONTENT ANO HEATING VALUE ANO THE SO_2 EMISSION FACTOR FOR COAL COMBUSTION FROM U.S. EPA OOCUMENT AP-42, THE EXPECTED SO_2 EMISSIONS OURING UNCONTROLLEO OPERATIONS ARE CALCULATED TO BE:

ACTUAL	4.63 POUNDS SO_2/MILLION BTU
ALLOWED	1.2 POUNDS SO_2/MILLION BTU

BASED ON THE ABOVE ANNUAL CDAL CONSUMPTION AND COAL HEATING VALUE, EQUIVALENT ANNUAL SO_2 EMISSIONS ARE ESTIMATEO TO BE:

ACTUAL	85,192 TDNS SO_2/YEAR
ALLOWED	22,080 TONS SO_2/YEAR
EXCESS	63,112 TONS SO_2/YEAR

Exhibit B-1

Engineering Statement Prepared by Bruce Varner

PART C: EPA and CIPS STAKE OUT THEIR POSITIONS

The first response by the EPA Chicago office to the start up of Newton I was to attempt to overturn the variance which had been granted to Newton I by the Illinois Pollution Control Board. On November 23, 1977, a memo proposing such action was sent by the Chicago office to Douglas Costle, EPA administrator. See Exhibit C-1 for the text of that memo.

The second move by the regional office of EPA was to recommend that EPA headquarters seek a preliminary injunction prohibiting Newton I from operating in violation of the NSPS and that fines of $25,000 per day of violation be imposed. The December 29, 1977 memo recommending that course of action is enclosed as Exhibit C-2. Note that the memo cites Bruce Varner's role in preparing the litigation report.

Bruce and his colleagues on the EPA legal staff hoped that these moves would convince CIPS to use low sulfur coal in Newton I as an interim measure until the scrubber became operational. It became clear that this strategy would not work when, on January 30, 1978, CIPS submitted a formal application to EPA headquarters for an innovative technology waiver under Section 111(j). The CIPS application included a detailed description of the innovative features of its DAFGD system (Exhibit C-2). Note that one of the claimed innovative features of the system is the use of the separate loop in the precooler to remove the chlorides from the flue gas prior to entering the scrubber.

Thus, in the short space of two months, EPA headquarters found itself faced with a three-pronged legal dilemma regarding Newton I: the proposal from the EPA Chicago office to overturn the Illinois Pollution Control Board variance; the recommendation, also from the Chicago office, that civil penalties be imposed for continued operation of the plant in violation of NSPS; and the request from CIPS for an innovative technology waiver. It would be a while before any of these issues could be resolved.

REGION V

SUBJECT: Disapproval of State Variance Order Pursuant to Section 113(d) of the Clean Air Act, as Amended

FROM: Valdas V. Adamkus
Deputy Regional Administrator

TO: Douglas M. Costle
Administrator (A-100)

I hereby recommend that you sign the attached letter to the Chairman of the Illinois Pollution Control Board disapproving the Opinion and Order of the Board in Central Illinois Public Service Company (CIPS) v. Environmental Protection Agency, PCB No. 77-145. This Order granted, in violation of Section 113(d) of the Clean Air Act as amended, a variance for CIPS, Newton, Unit I in Newton, Illinois.

CIPS commenced operation of Newton Unit I on September 10, 1977, without an operational sulfur dioxide removal system. The double alkali flue gas desulfurization control system for Newton Unit I is scheduled for completion by November 1979. Calculated sulfur dioxide emissions, assuming Newton Unit I is burning coal with a heating value of 11,500 BTU per pound and a sulfur content of 2.8%, are 4.6 pounds per million BTU. Both Federal New Source Performance Standards (NSPS) and Rule 204(a)(I) of Illinois Air Pollution Regulations, which forms a part of the Illinois implementation plan (SIP), require that the source meet a 1.2 pounds per million BTU sulfur dioxide emissions standard. On August 4, 1977, the U.S. EPA, Region V, issued a Notice of Violation based on anticipated violations, upon start-up then scheduled for in December 1977, of the Illinois SIP and Federal NSPS. A conference to discuss these violations with the Company was held in Chicago on August 24, 1977. The State of Illinois has not been delegated authority to enforce Federal NSPS. A litigation report is being prepared by U.S. EPA, Region V.

Newton Unit I, a 550 megawatt unit that is emitting sulfur dioxide at the rate of over 85,000 tons per year, is clearly a "major source" within the definition of Section 302(j) of the Clean Air Act as amended (Act) (42 U.S.C. Section 7602(j)).

Section 113(d)(I) of the Act (42 U.S.C. Section 7413(d)(I)) specifically prohibits the states from issuing any Administrative Order for a stationary source which specifies a date for final compliance with any requirement of an applicable plan later than the date for attainment of any national ambient air quality standard except pursuant to the requirements of Section 113(d)(I) of the Act. The attainment date for the national ambient air quality standard for sulfur dioxide in Jasper County, Illinois, was July 1975. The Illinois Order in question grants a variance from final compliance with Illinois regulations until November 3, 1979. The Order violates subparagraphs (C), (D), and (E) of Section 113(d)(I) of the Act.

Consequently, the Order is null and void according to the provisions of Section 113(d)(i) of the Act. See also Section 110(I) of the Act (42 U.S.C. Section 7410(I)). Accordingly, I recommend that you disapprove the above mentioned Opinion and Order of the Illinois Pollution Control Board.

Attachment

cc: Edward E. Reich, Director
Division of Stationary Source
Enforcement (EN-341)

Valdas V. Adamkus

Exhibit C-1

Internal EPA Memo
Recommending Disapproval of IPCB Waiver

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DEC 29 1977

Recommendation for U.S. EPA, Headquarters, Concurrence for Referral of a Litigation Report to Remedy Violations of the Clean Air Act by Central Illinois Public Service Company (CIPS), Newton Unit No. 1, Newton, Illinois

FROM: George R. Alexander, Jr.
Regional Administrator

TO: Marvin Durning
Assistant Administrator for
Enforcement (EN-329)

I am by this memorandum transmitting to you a litigation report and requesting your concurrence in the matter of Central Illinois Public Service Company (CIPS), Newton Unit #1, Newton, Illinois. The litigation report recommends initiation of a civil suit against CIPS for violations of the Clean Air Act, as amended. U.S. EPA seeks a preliminary injunction prohibiting the facility from operating in violation of Federal New Source Performance Standards (NSPS) and the Illinois State Implementation Plan (SIP), and civil penalties in the amount of $25,000 per day of violation. U.S. EPA, Region V, has calculated that CIPS is saving approximately $18,261 a day by its failure to limit emissions through pollution control equipment. Over a 26-month period this amounts to a total noncompliance savings of $14,426,572. I expect that your office will refer this package to the Department of Justice within five (5) working days of receipt.

CIPS, Newton Unit #1 was issued a Notice of Violation (NOV) by U.S. EPA, Region V, on August 4, 1977. A conference was held to discuss the violation on August 24, 1977. CIPS, Newton Unit #1 commenced operation on September 12, 1977, burning high sulfur coal without any controls for sulfur dioxide. CIPS has rejected the burning of low sulfur coal as an interim compliance strategy. Interim compliance by burning low sulfur coal for the 26-month period in question would cost CIPS an estimated $23,659,000, or $29,950 a day more than it would by burning high sulfur coal.

Because the double alkali flue gas desulfurization unit under construction (approximately 20% completed) at Newton is not scheduled to become operational until November 1979, and because U.S. EPA, Region V, does not believe the double alkali scrubber to be an innovative technology that would qualify for both a Section 111(k) waiver and a Section 113(d)(4) order, the case cannot be resolved administratively. Accordingly, it is recommended that U.S. EPA proceed directly to court.

The principal issue in this case concerns whether U.S. EPA can prove immediate and irreparable harm resulting from the startup and ongoing operation of CIPS, Newton Unit #1 in open violation of Federal NSPS for sulfur dioxide and the corresponding Illinois new source regulation for sulfur dioxide.

CIPS, Newton Unit #1 is presently emitting sulfur dioxide at the rate of over 85,192 tons per year. The maximum allowable rate is 22,030 tons per year. The Southeast Illinois Intrastate Air Quality Control Region, in which the power plant is located, is an attainment area for sulfur dioxide.

The attached litigation report was prepared by Bertram C. Frey, Enforcement Attorney, Region V, (FTS: 353-2082), and Bruce Varner, Engineer, Region V (FTS: 353-2086). The report summarizes the legal and technical issues that may arise, contains a draft complaint and documents pertaining to the case, and includes a list of witnesses.

Mr. Frey, whom I have designated as the Agency participating attorney, is willing and capable to take this cause to trial or to assist appropriate Department of Justice, United States, or other U.S. EPA attorneys in the filing, preparation, and trial of this matter.

In view of CIPS's open violations of Federal NSPS for sulfur dioxide and of the corresponding Illinois SIP sulfur dioxide standard for new sources, I request that this case be recommended for referral to the Department of Justice.

Attachment

cc: Mr. Edward E. Reich, Director
Division of Stationary Source
Enforcement (EN-341)

Exhibit C-2

Internal EPA Memo
Recommending Civil Action Against CIPS

Central Illinois Public Service Company Request for an Innovative Technology Waiver

BACKGROUND:

Section 111 of the Clean Air Act requires that certain new sources including electrical generating facilities meet New Source Performance Standards when such sources become operational. Section 111(j)(1) provides that a source may petition the Administrator of the U.S. Environmental Protection Agency for a waiver of the New Source Performance Standards if the proposed new source intends to use an innovative technological system of continuous emission reduction. The Administrator, with the consent of the governor of the state in which the source is located, may grant such a waiver for a period of time up to four years after the source commences operation.

The Central Illinois Public Service Company (CIPS) has constructed a 550 megawatt electrical generating facilty in Jasper County, Illinois. The unit became operational in October 1977 and is being operated in violation of New Source Performance Standards for sulfur dioxide.

In May 1977, CIPS applied to the Illinois Pollution Control Board for a variance from the sulfur dioxide regulations applicable to new emission sources. CIPS asked to be allowed to burn high sulfur coal from December 1977 to June 1979 without flue gas desulfurization (FGD) equipment, and from June 1979 to November 1979 with partial FGD equipment while they completed installation of a sulfur dioxide emission control system.

In its petition to the Board, CIPS stated that it was installing a double alkali flue gas desulfurization system (DAFGD) at a projected cost of $108 million. CIPS further stated that the proposed system would be considerably superior to FGD systems presently in operation. CIPS argued that the installation of such a system would not only allow the plant to burn local high sulfur coal, but also would save the utility and its customers money since the alternative would be to purchase more expensive low sulfur coal. The Board after notice and public hearing granted the variance in September 1977. Although the Board did not specifically deal with the issue of whether or not the proposed emission control system is "innovative," its opinion does state its agreement "...that considering this is the first application of this type of FGD system to a large utility boiler, the delay has been reasonable."

APPLICATION OF SECTION 111(J) TO NEWTON #1:

CIPS satisfies the legal requirements for an "innovative technology" waiver for the following reasons:

1. A double alkali flue gas desulfurization system has not been demonstrated on electric utility size boilers. This lack of demonstration has resulted in consultant design changes that have delayed construction of

the DAFGD, such that the system was unavailable for sulfur removal when the generating unit became operational.

A comprehensive summary of electric utility FGD systems in the U.S. is prepared bimonthly by PEDCO Environmental, Inc., Cincinnati, Ohio, for USEPA. The October - November 1977 report indicates that two double alkali systems are under construction and one is under contract. All three are planned to be operational in 1979. These three DAFGD systems are the first full scale systems to be used in the United States on electric utility size boilers, with the CIPS Newton system being twice as large as either of the other two applications.

2. There is a substantial likelihood that the DAFGD system being constructed at Newton Unit 1 will achieve greater continuous sulfur dioxide removal than existing FGD systems because of potential reductions in scaling, plugging, erosion and corrosion problems associated with existing FGD systems. Double alkali scrubbing has been developed largely to avoid the scaling, plugging and erosion problems associated with lime and limestone systems. Scaling and erosion are caused by calcium compounds formed in the scrubber which are insoluble and precipitate out. On the other hand, the use of a soluble sodium alkali results in the formation of a soluble sodium compound and thus a scrubbing solution instead of a slurry as in the case of calcium. In addition, sodium alkali is more reactive than lime or limestone resulting in DAFGD systems having very high sulfur dioxide removal efficiences with low liquid to gas ratios and thus lower pressure drop in the scrubber. The CIPS DAFGD system also includes a pre-cooler water spray system with downstream mist eliminator for removal of chlorides from the gas stream prior to scrubbing. Chlorides are strong oxidizing agents and contribute to corrosion problems. Successful demonstration of this unique pre-cooler function could improve the operation of other FGD systems. In addition, the CIPS DAFGD system is a closed loop system resulting in no liquid waste other than that which leaves with the stabilized sludge.

Air quality studies indicate that uncontrolled sulfur dioxide emissions from the Newton facility will not result in violations of either the primary or secondary National Ambient Air Quality Standards for sulfur dioxide for the period of the requested waiver.

4. An examination of the congressional record indicates that the intent of Congress in adopting Section 111(j) was to provide an extension of the compliance deadlines for New Source Performance Standards to companies installing innovative technology such as that being installed at the Newton facility. In addition, absence of specific language in the Clean Air Act which excludes waivers under Section 111(j) for sources under construction prior to August 7, 1977 indicates that such waivers are applicable to any "new source" subject to Section 111 which applies innovative technology.

The prospective language of Section 111(j) is simply consistent with the purpose and intent of Section 111 as a whole in that it establishes standards of performance for new stationary sources where definition of a new source is specifically identified for each source category having an established standard.

GLM:sh2529/1-3

PART D: RESOLUTION (?) OF LEGAL ISSUES

None of the three legal issues raised in Part C were disposed of neatly or quickly. In this part, we explore the fate of each one separately even though developments were occurring on all three fronts simultaneously.

Innovative Technology Waiver

CIPS' request for an innovative technology waiver was the first such request to be filed under the new Section 111(j) language (which had only been enacted into law the previous August). Hence there was no administrative or judicial precedent which EPA could rely on to evaluate CIPS' application. In fact, the ruling that was made several months later did not even address the question of whether the DAFGD system was an innovative technology under Section 111(j).

In April 1978, EPA Administrator Douglas Costle ruled that CIPS was ineligible for an innovative technology waiver for the Newton I plant since their application for the waiver had not been submitted until after the plant had begun operation. See Exhibit D-1 for Mr. Costle's letter spelling out the reasons for the waiver denial.

CIPS appealed Mr. Costle's decision and the case went to the Seventh Circuit U.S. Court of Appeals (Appeals from EPA decisions are taken to the U.S. Appeals Court of the Appellate circuit in which the plant is located.) Extensive briefs were filed with the court by both CIPS and EPA. In short excerpts from those briefs, one of the key arguments made by CIPS to the court is shown in Exhibit D-2; EPA's rebuttal of the argument is contained in Exhibit D-3. In Spring 1979, more than a year after the original request was made, the Court ruled that the CIPS request for an innovative technology waiver should not be denied solely on the basis that the application was filed after the plant had begun operations. The court directed EPA to rule on the waiver petition on the basis of the merits of the application. See Exhibit D-4 for the court decision.

IPCB Variance

During the same time period, EPA headquarters gave the go-ahead to the proposal to negate the variance provided to Newton I by the Illinois Pollution Control Board. On May 10, 1978 the proposed EPA action was announced in the Federal Register. However, after receiving comments from

both CIPS and the Illinois Environmental Protection Agency, the proposed disapproval was withdrawn by EPA on November 28. Both the initial announcement and the withdrawal are reproduced in Exhibit D-5.

Civil Penalties

EPA headquarters agreed with the recommendation of the regional office to pursue civil penalties against CIPS and referred the case to the U.S. Department of Justice. However there were several developments which prevented early resolution of this issue.

First of all, EPA headquarters was in the process of revising its policy with regard to civil penalties for violation of the Clean Air Act. The new policy statement, distributed to the EPA regional administrators on April 11, 1978, contained among other matters, provisions for adjusting the penalty level to account for the economic benefits which the violator received by not complying with the regulation. The procedures for calculating the economic benefits went through several iterations before being issued in an EPA Technical Support Document on September 27, 1978. In the meantime, that June Bruce Varner and other officials of the EPA office in Chicago conducted an on-site inspection of the Newton I plant to verify its non-compliance with the regulations.

It was one thing for EPA to adopt policies and procedures regarding civil penalties. It was another matter to get the Department of Justice to go along with them. In fact, there was a protracted disagreement between the two organizations over whether the provisions for recapturing economic benefits could be applied to utility companies. The hassles between EPA and Justice on this issue surfaced as a feature story in the January 19, 1979 issue of the Environment Reporter (see Exhibit D-6). The conflicting views of the two organizations were finally reconciled later that Spring at approximately the same time as the court directed EPA to rule on the merits of CIPS Section 111(j) waiver request.

EPA and CIPS Negotiate

On June 26, 1979 Bruce Varner and other representatives of the EPA Region V office flew to Washington D.C. for a conference with officials from EPA headquarters, the Justice Department and CIPS. The purpose of the conference was to arrive at a mutually acceptable resolution of the

remaining issues without having to go through a long, drawn-out court suit. Within several months of that meeting EPA and CIPS agreed on language for a proposed settlement but approval of the settlement by the Justice Department took an additional year.

The entire matter was finally resolved when a joint CIPS-EPA-Department of Justice agreement was reached. According to the agreement, the United States filed a Complaint against CIPS in the United States District Court for the Central District of Illinois (Civil Action No. 80-3371), charging that CHIPS had violated the New Source Performance Standard for SO_2 control at the Newton I and requesting a fine of $25,000 against CIPS. Simultaneously, a Consent Decree was submitted to the Court for approval. The Consent Decree settled all claims alleged in the Complaint, included the $25,000 fine, and a CIPS agreement to withdraw its request for a section 111 (j) waiver. The Consent Decree was approved by the Court on December 3, 1980.

By this time the Newton I scrubber had been operational for a year. However, poor performance of the DAFGD system during 1980 led to EPA issuing a notice of violation early in 1981. Informal discussions between EPA and CIPS and improved scrubber performance over the next several months, led to a mutually satisfactory resolution of that issue. At long last, the legal battles between CIPS and EPA over Newton I were over.

Mr. David F. Peters
Hunton and Williams
707 East Main Street
P.O. Box 1535
Richmond, Virginia 23212

Dear Mr. Peters:

Your January 30, 1978 letter directed to the attention of Edward E. Reich, Director of the Division of Stationary Source Enforcement, requested, pursuant to section 111(j) of the Clean Air Act, as amended, 42 U.S.C. #7411(j), a waiver of New Source Performance Standards (NSPS) for Central Illinois Public Service Company's (CIPS) Newton Power Station Unit 1, near Newton, Illinois. You enclosed an application for a waiver which included supporting documentation for the waiver request.

According to the information supplied in your application, Newton Unit 1 began operation on November 18, 1977. After an examination of the statutory language and legislative history of section 111(j), I have determined that Congress did not intend to permit sources already operating to seek waivers under section 111(j) of the Clean Air Act.

Section 111(j) (1) (A) of the Act provides, inter alia, that "[a]ny person proposing to own or operate [emphasis supplied] a new source may request the Administrator" for a waiver from the requirements of NSPS in order to encourage use of innovative technology. Further, section 111(j)(1)(A) provides that such waivers may be granted only with the "consent of the Governor of the State in which the source is to be located." [Emphasis supplied.] In addition, sections 111(j) (1) (A) (i), (ii) and (iii) refer to the "proposed source" and "proposed system". Because the prospective language of section 111(j) indicates that a waiver request is to be filed before operation commences, it is my determination that your January30, 1978 request is untimely and that CIPS Newton Unit 1, is ineligible for a waiver from the New Source Performance Standard.

Sincerely yours,

Douglas M. Costle

cc: George R. Alexander, Jr.
Regional Administrator, Region V

Exhibit D-1

EPA Denial of Innovative Technology Waiver

EPA's interpretation of the statute in this case has the effect of discouraging the development of innovative technology, a result totally at odds with Congress' intent. CIPS, of course, had the option from the outset of constructing more traditional means of SO_2 control such as a limestone scrubber. Because of the numerous operating problems encountered with such systems (A. 22-23), however, CIPS elected to install a system that would afford a much more effective and reliable means of emission control. This first application of DAFGD technology on a large utility boiler will have cost CIPS far in excess of the more conventional equipment, but its demonstration at Newton Unit 1 will be a major advance in the art of SO_2 emission control. That the system was not complete as planned when it was necessary to begin generating electricity at the unit is unfortunate, but the unanticipated design changes and construction delays resulting from the newness of the technology were hardly the fault of CIPS. Yet, under EPA's narrow reading of the statute, any source electing to pursue innovative technology must early anticipate that problems will arise and that delays will occur; otherwise, it proceeds at its own risk. In this case, CIPS did not have the benefit of such crystal ball wisdom, and in any event could not be expected to pursue in advance waver relief that did not become available by statute until the passage of the Clean Air Act Amendments of 1977 (August 7, 1977), little more than one month prior to the date operating tests on the unit were to begin.

If EPA's interpretation of the statue is to prevail, CIPS clearly would have been better served by electing a less effective but conventional means of emission control -- a system that may have been much simpler to construct, but one which would be far less effective in controlling emissions. Accordingly, rather than encouraging the development of innovative technology as Congress intended, EPA's reading of the statute can only discourage it.

Exhibit D-2

Excerpt from CIPS Brief to Court

CIPS also argues that the Agency's position provides a disincentive to the development of innovative technology. Pet. Br. 21. This argument also misses the mark. The obvious purpose of a Section 111(j) waiver is to encourage a prospective operator of a new source to consider the adoption of innovative control technology. This purpose is fully served under EPA's policy of entertaining waiver applications from prospective operators. Thus if a prospective source owner applies for and receives a waiver he may proceed to install the technology with the protection of the waiver. But once an operator has begun construction of a particular system, as CIPS has done, a Section 111(j) waiver is no longer needed as an incentive.

Exhibit D-3
Excerpt from EPA Brief
to Court

CENTRAL ILLINOIS PUBLIC SERVICE COMPANY, Petitioner,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Respondent.

No. 78-1775.

United States Court of Appeals, Seventh Circuit.

Argued Feb. 15, 1979.

Decided March 23, 1979.

On petition for review of final determination by the Environmental Protection Agency, the Court of Appeals, Castle, Senior Circuit Judge, held that the Clean Air Act permits a company to apply for an innovative technology waiver of new source performance standards after putting into operation the new source for which the waiver is sought.

Reversed and remanded.

Health and Environment ⇐28

The Clean Air Act permits a company to apply for an innovative technology waiver of new source performance standards after putting into operation the new source for which the waiver is sought, consisting of any facility, constructed after publication of the performance standard applicable to such source, that emits or may emit any air pollutant. Clean Air Act, § 111(a)(2, 3), (j), 42 U.S.C.A. § 7411(a)(2, 3), (j).

David F. Peters, Richmond, Va., for petitioner.

Barbara Brandon, Dept. of Justice, Washington, D. C., for respondent.

Before FAIRCHILD, Chief Judge, CASTLE, Senior Circuit Judge, and WOOD, Circuit Judge.

CASTLE, Senior Circuit Judge.

The questinn presented is whether section 111(j) of the Clean Air Act, 42 U.S.C. § 7411(j), permits a company to apply for an innovative technology waiver of new source performance standards (NSPS) after putting into operation the new source[1] for which the waiver is sought. The Administrator of the Environmental Protection Agency, believing himself bound by the statute, denied a waiver in this situation on the ground of untimely application. We conclude that the statute does not require application prior to startup of the source and hence remand to the Administrator for the exercise of his discretion.

In August, 1973, Central Illinois Public Service Company (CIPS) commenced construction of a coal-fired generator near Newton, Illinois. In September, 1977, the generator was started up[2] even though the innovative double alkali flue gas desulfurization (DAFGD) system for control of sulfur dioxide emissions had not yet been completed. The month preceding startup, new amendments to the Clean Air Act became effective, under which new sources experimenting with innovative emission control systems could apply for a waiver from the performance standard normally applicable to the source.[3] On August 4, 1977, prior to

startup nf the Newton generator, the EPA had notified CIPS that it would be in violation of federal and state sulfur dioxide emission limits upon startup of the generator. After receiving this notice, CIPS had engaged in informal discussions with the EPA concerning the appropriate course of action, but it did not formally apply for a section 111(j) waiver of new source performance standards until January 30, 1978. By letter of April 26, 1978, the Administrator of EPA denied the waiver request on the ground that it was untimely under the terms of section 111(j). It is this final determination of the Administrator which is now under review. We conclude that the statute did not bind him to dismiss the waiver request as untimely and accordingly remand to the Administrator for the exercise of his discretion.

Section 111(j) of the Clean Air Act states:

> (1)(A) Any person proposing to own or operate a new source may request the Administrator for one or more waivers frum the requirements of this section for such source or any portion thereof with respect to any air pollutant to encourage the use of an innovative technological system or systems of continuous emission reduction. The Administrator may, with the consent of the Governor of the State in which the source is to be located, grant a waiver under this paragraph, if the Administrator determines . . . that [the "proposed system" satisfies certain statutory criteria.]

42 U.S.C. § 7411(j)(1)(A). The section also provides that the owner or operator of the "proposed source" must demonstrate that the proposed system will not endanger the public health, welfare, or safcty. Based on the language "proposing to own or operate," "is to be located," "proposed system," and "proposed source," the Administrator concluded that a company already operating a new source could not apply for a waiver. Apparently he interpreted the language to require application during the proposal stage of the project, which would clearly bar an application made after the project had already commenced operations. We do not believe that the language can be given this literal interpretation, however, because a project becomes more than a proposal once construction commences, yet the EPA agrees that application for a waiver may be made during construction. EPA Brief at 13. If application is not restricted to the proposal stage, the rationale for the Administrator's denial of a post-startup application falls. Moreover, even if the cited language is construed as impliedly providing for pre-startup application, such a provision would at most be directory rather than mandatory as startup *per se* has no substantive significance to waiver eligibility.[4] Startup in violation of emission limits would be significant in view of the prohibition of section 111(e),[5] however the Administrator's decision relied neither on the latter section nor on the fact that the Newton unit was in violation of NSPS at the time of application. We therefore express no view at this time on whether section 111(e) would bar grant of a waiver to a company applying when already in violation.

We do not consider the legislative history relevant to the present issue as one senator's citation by way of example of the New Mexico utility's situation does not imply that his colleagues, or even the senator in question, intended the legislation to cover the variety of problems faced by that utility. This is particularly so as Congress presumably knew that the New Mexico utility could obtain relief by entering into a consent decree with the EPA,[6] so there is no reason to assume that it intended the 1977 amendments to cover that utility's situation.

Reversed and Remanded.

1. A "new source" is any facility which emits or may emit any air pollutant, the construction of which is commenced after the publication of a performance standard applicable to such source. 42 U.S.C. §§ 7411(a)(2) and (a)(3).

2. The generator was not put into commercial operation until November, 1977, however it was "started up" for purposes of the regulations when it was test-fired in September. See 40 C.F.R. § 60.2(o). CIPS accepted this interpretation at oral argument.

3. The Newton unit was clearly a "new source," even though constructed prior to the effective date of section 111(j), since it was constructed after the publication (in 1971) of performance standards for coal-fired boilers. See 36 Fed. Reg. 24876 (Dec. 23, 1971). The DAFGD system was eligible for an innovative technology waiver as it had never been tested on a facility as large as the Newton generator. The waiver, if obtained, could have authorized operation of the generator pending completion of the DAFGD system since the untreated emissions from the unit did not violate national ambient air quality standards for the protection of the public health and safety. See 42 U.S.C. § 7411(j)(1)(B). Once the emission control system was operating, a waiver could also have permitted emissions in excess of NSPS for a limited period in the event the DAFGD system did not prove as effective as anticipated.

4. The general rule of statutory construction is that if a provision relates to the essence of the thing to be done so that noncompliance will frustrate the legislative intent, it is mandatory. On the other hand, if a provision relates to a detail of procedure rather than to substance, it is directory. *Van Keppel v. United States*, 206 F.Supp. 42, 44 (D.Kan.1962).

5. (e) After the effective date of standards of performance promulgated under this section, it shall be unlawful for any owner or operator of any new source to operate such source in violation of any standard of performance applicable to such source.

42 U.S.C. § 7411(e).

6. The Public Service Company of New Mexico did in fact enter into a consent decree with the EPA. This option was no longer available to CIPS after the 1977 amendments.

Exhibit D-4

Appeals Court Decision on CIPS vs. EPA

[6560-01]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 65]

[FRL 892-6]

STATE AND FEDERAL ADMINISTRATIVE ENFORCEMENT OF IMPLEMENTATION PLAN REQUIREMENTS AFTER ~~STATUTORY~~ DEADLINES

Proposed Disapproval of an Administrative Order Issued by the Illinois Pollution Control Board to Central Illinois Public Service Co.

AGENCY: Environmental Protection Agency.

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency proposes to disapprove an administrative order issued by the Illinois Pollution Control Board to Central Illinois Public Service Co. requiring final compliance with the applicable requirements of the federally approved Illinois State Implementation Plan (SIP) by November 3, 1979. Because the order has been issued to a major source and permits a delay in compliance with provisions of the SIP, it must be approved by EPA before it becomes effective as a delayed compliance order under the Clean Air Act. Disapproval of the order is proposed because it does not meet certain requirements of the Clean Air Act. If approved by EPA, the order would constitute an addition to the SIP and would alter the rights of persons to bring judicial actions against the source for violations of the SIP. The purpose of this notice is to invite public comment on EPA's proposed disapproval of the order as a delayed compliance order.

DATES: Written comments must be received on or before June 9, 1978.

ADDRESSES: Comments should be submitted to Director, Enforcement Division, U.S. EPA, Region V, 230 South Dearborn, Chicago, Ill. 60604. The Illinois Order, supporting materials, and public comments received in response to this Notice may be inspected and copied (for appropriate charges) at this address during normal business hours.

FOR FURTHER INFORMATION CONTACT:

Bertram C. Frey, Legal Section Enforcement Division, U.S. EPA, Region V, 230 South Dearborn, Chicago, Ill. 60604, telephone 312-353-2082.

SUPPLEMENTARY INFORMATION: Central Illinois Public Service Company commenced operation of Newton Unit 1, Newton, Ill. (Jasper County), on September 10, 1977, without an operational sulfur dioxide removal system. The double alkali flue gas desulfurization control system for Newton Unit 1 is scheduled for completion by November 1979. Calculated sulfur dioxide emissions, assuming Newton Unit 1 is burning coal with a heating value of 11,500 Btu per pound and a sulfur content of 2.8 percent, are 4.6 pounds per million Btu. Both Federal New Source Performance Standards (NSPS) and Rule 204(a)(1) of Illinois Air Pollution Regulations, which forms a part of the Illinois State Implementation Plan (SIP), require that the source meet a 1.2 pounds per million Btu sulfur dioxide emission standard. On August 4, 1977, the U.S. EPA, Region V, issued a Notice of Violation based on anticipated violations, upon start-up then scheduled for December 1977, of the Illinois SIP and Federal NSPS. A conference to discuss these violations with the Company was held in Chicago on August 24, 1977.

On September 1, 1977, the Illinois Pollution Control Board issued an Administrative Opinion and Order in *Central Illinois Public Service Company v. Environmental Protection Agency*, PCB No. 77145, granting a variance that provides for final compliance with the applicable requirements of the Illinois State Implementation Plan by November 3, 1979. This date is later than allowed by section 113(d)(1)(D) of the Clean Air Act as amended (42 U.S.C. section 7413(d)(1)(D)) (hereinafter "Act"). The Order also fails to notify Central Illinois Public Service Co., Newton Unit 1, a major source (550 megawatts) under construction in Newton, Ill., that it would be required to pay a noncompliance penalty under Section 120 of the Act (42 U.S.C. section 7420) in the event that the source fails to achieve final compliance by July 1, 1979. This failure constitutes a violation of section 113(d)(1)(E) of the Act. Moreover, the Order fails to require compliance with applicable interim requirements as provided by paragraphs (6) and (7) of section 113(d) and contains no requirement for emission monitoring and reporting by the source of the Act (42 U.S.C. sections 7410(a)(2)(F), 7414(a)(1)). This third deficiency in the Order is violative of section 113(d)(1)(C) of the Act.

Because the Order has been issued to a major source of sulfur dioxide emissions and permits a delay in compliance with the applicable Illinois regulation, it must be approved by U.S. EPA before it becomes effective as a delayed compliance order under section 113(d) of the Act. U.S. EPA must disapprove the Order if it does not satisfy the requirements of this subsection. Because of the reasons mentioned above U.S. EPA is proposing to disapprove the Order. If the Order is approved by EPA, compliance with its terms would preclude federal enforcement action under section 113 of the Act against the source for violation of the regulation covered by the order during the period the order is in effect. Enforcement against the source under the citizen suit provision of the Act (section 304) would be similarly precluded. If approved the order would also constitute an addition to the Illinois State Implementation Plan for the purposes of sections 110 ("Implementation Plans"), 304 ("Citizen Suits"), and 307 ("General Provisions Relating to Administrative Proceedings and Judicial Review") of the Act.

The purpose of this notice is to invite public comment on EPA's proposed disapproval of this Order as a delayed compliance order. After the public comment period, and after EPA has reviewed any comments received in response to this notice, the Administrator of EPA will publish in the FEDERAL REGISTER the Agency's final action on the Order in 40 CFR Part 65. The provisions of 40 CFR Part 65 will be promulgated by EPA soon, and will contain the procedures for EPA's issuance, approval, or disapproval of an order under section 113(d) of the Act. In addition, Part 65 will contain sections summarizing orders issued, approved, or disapproved by EPA. A prior notice proposing regulations for Part 65, published at 40 FR 14876 (April 2, 1975), will be withdrawn, and replaced by a notice promulgating these new regulations.

Dated: April 14, 1978.

GEORGE R. ALEXANDER, JR.,
Regional Administrator.
Region V.

[FR Doc. 78-12634 Filed 6-9-78; 8:45 am]

Exhibit D-5

EPA Announcements Re: IPCB Variance

[6560-01-M]

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 65]

[FRL 1014-2]

STATE AND FEDERAL ADMINISTRATIVE ORDERS PERMITTING A DELAY IN COMPLIANCE WITH STATE IMPLEMENTATION PLAN REQUIREMENTS

Withdrawal of a Proposed Disapproval of an Administrative Order Issued by Illinois Environmental Protection Agency to Central Illinois Public Service Company

AGENCY: U.S. Environmental Protection Agency.

ACTION: Withdrawal of Proposed Disapproval.

SUMMARY: U.S. EPA is withdrawing its proposed disapproval of an Administrative Order issued by the Illinois Environmental Protection Agency to Central Illinois Public Service Company. The proposed disapproval was published in the FEDERAL REGISTER on May 10, 1978.

This action is being taken in response to the comment published below.

FOR FURTHER INFORMATION CONTACT:

Bertram Frey, Attorney, Enforcement Division, U.S. Environmental Protection Agency, 230 South Dearborn Street, Chicago, Illinois, 60604 312-353-2082.

SUPPLEMENTARY INFORMATION: The notice invited public comment on the proposed disapproval. Two comments were received. Central Illinois Public Service Company sent a comment to U.S. EPA on June 7, 1978. The U.S. EPA responded to this comment in a letter on August 8, 1978. The second comment received from the Illinois Environmental Protection Agency (IEPA), is shown below.

Re EPA Proposed Disapproval of Delayed Compliance Order for Central Public Service, 43 FR 20022, May 10, 1978.

Dear Mr. McDonald: In response to request for written comments appearing in Notice in FEDERAL REGISTER Vol. 43, No. 91, dated Wednesday, May 10, 1978, the Illinois Environmental Protection Agency (hereinafter referred to as the "Agency") has the following comments to make:

1. The Agency was aware of the deficiencies of Illinois Pollution Control Board Order PCB 77-145 (hereinafter referred to as the "Order") in respect to variance granted to Central Illinois Public Service *Company Newton United I* (hereinafter referred to as the "Petitioner") in that the Order granted a variance for final compliance later than July 1, 1979, as allowed by Section 113(d)(1)(D) of the Clean Air Act as amended (42 U.S.C. Section 741d(d)(1)(D) hereinafter referred to as the "Act"). The Agency was also aware that the Order failed to notify the Petitioner that it would be required to pay penalties under the provisions of Section 120 of the Act if the Petitioner failed to achieve final compliance by July 1, 1979, also that the Order failed to require compliance with applicable interim requirements as provided by paragraph (6) and (7) of Section 113(d) of the Act, and contained no requirement for emission monitoring and reports contrary to the provisions of Section 113(d) of the Act.

2. Because of the deficiencies referred to in comment 1 above, the Agency was mindful that a Delayed Compliance Order would probably not be approved by the Administrator as an addition to the Illinois State Implementation Plan under the provisions of Section 110 of the Act. Therefore, the Agency as the official State authority, under the provisions of Section 4m of the Illinois Environmental Protection Agency Act, designated to submit State implementation Plans or their revisions to the Administrator for approval did not do so for the reasons stated above.

3. The Board's Order in this instance is a shield against State Prosecution of the Petitioner for violations of Section 9(b) of the Illinois Environmental Act or regulation 204(a)(1) of the Illinois Air Pollution Control Regulations, although such Order was deficient under the provisions of the Clean Air Act.

The U.S. EPA finds the IEPA's point well taken. Since the IEPA has not made an official submittal of the Order in question for U.S. EPA approval, the U.S. EPA is withdrawing its proposed disapproval.

Dated: November 14, 1978.

JOHN MCGUIRE,
Regional Administrator.

[FR Doc. 78-33095 Filed 11-27-78; 8:45 am]

Exhibit D-5, cont.

EPA/JUSTICE SPLIT LEADING TO DELAYS IN ACTIONS AGAINST REGULATED UTILITIES

Federal enforcement actions against public utilities are being delayed in numerous cases because of a protracted disagreement between the Environmental Protection Agency and the Department of Justice over enforcement strategy.

The disagreement, which has been going on for at least 10 months, centers around how EPA's civil penalties policy might apply to regulated monopolies.

Justice Department officials, and some within EPA, say the policy, designed to recapture profits resulting from delayed compliance, does not apply logically or "intellectually" to regulated utilities.

Because the utilities' rate bases and rates of return are controlled by law, these officials maintain, the utilities themselves do not gain by delaying compliance.

Moorman: 'Take Some Action'

The disagreement between Justice and EPA officials on the question has come to a head since the start of the year with a Justice official "urging" and "pleading" with EPA Administrator Douglas M. Costle to "take some action."

Justice and EPA must resolve their differences "by either coming to agreement or by agreeing to disagree so that this very important area of litigation can proceed," Assistant Attorney General James W. Moorman told Costle in a letter January 4.

Reminding Costle that Moorman and Justice Pollution Control Section Chief Angus MacBeth had raised the issue to Costle in March 1978, Moorman said: "At that time we saw a problem arising from the circumstance that utility rate bases and rates of return are controlled by law. We did not see exactly how a regulated monopoly gained or lost economic benefit from making or not making any particular investment so long as the regulatory authority was functioning properly."

Moorman noted that a report prepared by EPA by the Boston consulting firm of Temple, Barker and Sloane "generally agreed with us" that the civil penalty policy cannot apply to regulated utilities the same as it applies to for-profit industries.

No Authorization to File Suits

"I advised Marvin Durning [EPA Assistant Administrator for Enforcement] that I couldn't authorize the filing of suits against regulated monopolies," Moorman told Costle in the letter of January 4.

Moorman said he was not surprised at the consulting firm's conclusions, because Temple, Barker and Sloane experts had testified publicly in the *West Penn Power* case that installing scrubbers "would not be economically onerous to the company since the cost would pass into the rate base and would not affect the company's rate of return."

A Temple, Barker and Sloane official contacted by Environment Reporter confirmed the accuracy of Moorman's characterization of the consultant's testimony. But he noted also a potential for "regulated lag" in the Pennsylvania utility commission's rate-passthrough actions, and he noted some concerns about the fairness and reasonableness of utility rates of return in Pennsylvania.

The TBS official said he was not free to comment on the report the firm did for EPA on the penalty policy as it applies to regulated utilities.

In his letter to Costle, Moorman noted too that Attorney General Griffin Bell on October 3, 1978, had written Costle and had "touched on this issue."

Bell said "he did not understand how utilities and regulated monopolies made a profit on delayed compliance," Moorman pointed out to Costle.

Moorman noted too that under a 1977 EPA/Justice memorandum of understanding, EPA still could choose to pursue the enforcement cases on its own if it cannot reach agreeement with Justice.

Litigation Referrals 'Inappropriate'

"The Justice Department continues to receive litigation referrals from EPA asking that penalties be sought against regulated monopolies on the theory that they obtain economic benefit or profit from delaying investment in pollution control equipment," Moorman said.

"These referrals appear to be inappropriate insofar as the issue has not, to our knowledge, been resolved at EPA and communicated to us. In any event, we would like to resolve this issue by either coming to agreement or by agreeing to disagree so that this very important area of litigation can proceed," Moorman said.

"I again plead for an early resolution of the issue," concluded Moorman, who heads Justice's Land and Natural Resources Division.

Citing an attorney/client relationship between Justice and EPA, officials in both agencies declined to speak openly on the situation.

Number of Cases, Penalty Amount

Two officials, however, told Environment Reporter that some 150 enforcement actions potentially involving as much as one-half billion dollars have been held up because of the EPA/Justice disagreement.

Both of those figures, however, were soundly rejected by EPA Assistant Administrator Durning, who said they are "completely inaccurate," and by Durning's special assistant, Michael Richardson, who said the true figures are "orders of magnitude lower."

Contacted January 17 concerning Moorman's letter, Durning said the actual penalties involved in the deferred cases are based on a complex mix of factors involving which sources are deemed in violation, how long they have been in violation, state implementation plan requirements, pollutants involved, and technology involved.

Regarding the one-half billion dollar figure, Durning said, "You're not talking about reality in any way. If we were talking about $50 million, then we'd be talking about details."

The one-half billion dollar figure nonetheless was first arrived at within EPA itself, and Richardson said the figure was "based on total mega-wattage out of compliance."

That approach includes many mega-wattages not subject to civil penalties, Richardson said, adding that some specific cases have been handled through delayed compliance orders.

Durning, reluctant to discuss an issue that may affect on-going litigation, said the actual penalties involved in the

Exhibit D-6

Article on EPA/Justice Disagreement reprinted by permission from Environment Reporter

Justice/EPA disagreement are "so much lower that the $500 million figure is completely out of line."

Durning and Richardson also disagreed with the figure of some 150 enforcement action actually being deferred.

Durning said that in some instances, a case applies to a single plan or facility while in others a single case might apply to numerous plants owned by a single company.

Furthermore, Durning said, numerous cases can be brought against a single plant in an effort to get at several different pollutants.

"We would believe that the number of cases is more like 40 than 150," Durning said, noting that some of those cases are very "small" and "hardly worth a note in the BNA Environment Reporter."

He said the actual number of plants and facilities against which enforcement actions have been delayed because of the EPA/Justice disagreement totals more than 40, but "far fewer" than 150.

Half Air, Half Water Cases

Durning said the cases being delayed over the past 10 months are roughly half air pollution and half water pollution cases.

The water pollution cases are "not nearly so large" in terms of potential penalties, Durning said, adding that the potential for installing scrubbers on power plants makes the air pollution cases "orders of magnitude" more costly than the water pollution cases.

Referring to the Temple, Barker and Sloane report which disputes his own position that the penalty policy applies to regulated utilities just as it does anyone else, Durning said the consultant "worked on assumptions and data they were given" by EPA.

The consultant's conclusions "do not conform with the facts as they are," he said, adding that EPA may have given Temple, Barker and Sloane "very high, mistaken figures."

Durning also said he rejects suggestions by some that he has been indecisive on the issue of how the penalties policy should apply to regulated utilities. He pointed to complicating factors such as how the issue will relate to EPA's upcoming Air Act Section 120 noncompliance penalty regulations, which will apply to utilities.

Durning noted too that significant enforcement settlements have been reached with major utilities such as the Tennessee Valley Authority (Current Developments, December 15, 1978, p. 1451) and West Penn Power Company (see related story, p. 1724).

He and Richardson noted too that major enforcement settlements have been made public involving an Ohio Edison facility and other utilities.

One EPA official critical of the agency's position in the Justice/EPA disagreement said there is "no dispute within the agency" that substantial penalties should be levied against noncomplying public utilities.

But the official said EPA is taking an iron-clad position on the penalty policy and will be vulnerable to arguments in court that the policy does not apply "intellectually" to regulated utilities.

Another apparent concern is the notion of Government lawyers' having to try to convince a jury that officials for regulated utilities behave just like their profit-making industry counterparts when it comes to trying to defer capital expenditures and increase profits.

Proving such behavioral traits in court would be impossible, according to this theory.

Senate Staff Backs EPA

Asked for his reaction to the EPA/Justice enforcement disagreement, Karl Braithwaite, of the Senate Environmental Pollution Subcommittee, told Environment Reporter January 16 that Senate staffers hope EPA and Justice soon will resolve their differences themselves.

In the meantime, Subcommittee Chairman Edmund S. Muskie (D-Maine), for whom he works, has not been brought into the fray, Braithwaite said.

However, Braithwaite said he sees "no sensible basis for making a distinction" between regulated utilities and others on the enforcement policy.

"The idea that utilities might not be subject to the policy appalls me," he said.

Referring to subcommittee staff, Braithwaite said, there is a "unanimous, firm view that we see no basis for treating utilities any differently."

EPA Could Choose to Defend Itself

The long-standing disagreement apparently has been brought to the front by Moorman's letter to Costle of January 4, and EPA's Office of Enforcement since has been working feverishly to give Costle final recommendations.

Under the 1977 memorandum of understanding, the EPA Administrator could ask Attorney General Bell to review the question or the agency could decide to live with the differences — in effect, agree to disagree — and be represented by its own attorneys rather than by Justice attorneys in the litigation.

There were signs that EPA was considering using its own somewhat-limited staff of attorneys in the cases, but no decision yet has been reached within the agency on how to proceed. The agency would prefer not to use its own attorneys because of constraints on EPA legal resources and because of other work EPA attorneys presumably would have to put aside.

PART E: OPERATIONAL PROBLEMS ENCOUNTERED

Legal difficulties were not the only problem that CIPS had with the Newton I scrubber. Many sifnificant technical problems were also encountered, some of which are highlighted in this part of the case.

A Test Engineer at Newton I

Among the many individuals responsible for identifying, diagnosing, and correcting operational problems with the DAFGD system for Newton I was Mr. Jerry Simpson. Jerry, who grew up in Martinsville, Illinois not far from where the Newton I plant was built, received his degree in mechanical engineering from Rose-Hulman in 1978. After graduation, he went to work for CIPS as a test engineer at Newton I. Jerry and his colleagues had their hands full over the next few years trying to get the Newton I scrubber performing satisfactorily.

Problems with the Precooler

Design data for the scrubber are contained in Exhibit E-1 which also includes performance data from September 1979, when initial DAFGD operations began, through December 1980. Note that even though the system passed an EPA compliance test in December 1979 with flying colors, performance deteriorated markedly over the next several years.

Some of the initial operational difficulties encountered during that period involved the precoolers, which were designed to remove much of the hydrogen chlorides from the gas stream prior to scrubbing. The precooler liquor provided an extremely corrosive environment. Typical concentrations in the 130° F. liquor (which had a pH of 0.5-2.0) were 1.6% HCL, 10.8% H_2SO_4, and 2.7% Cl. While the precooler valves and pipes were lined with chlorobutyl rubber, frequent penetration of the linings by particles in the gas stream led to major corrosion problems. Severe corrosion was experienced throughout the precooler loop wherever carbon steel, 316 or 317 stainless steel, or incoloy was exposed to the low pH liquor. For a while, the system was averaging one valve failure per week (at $5,000 per valve!).

Another trouble spot was the precooler mist eliminators, which were installed to help prevent carryover of the precooler liquor into the scrubber loop, thereby minimizing soda ash consumption and corrosion problems in the scrubber

loop. Mist eliminators resemble venetian blinds hung sideways. They force the gas/vapor stream to sharply change direction. The gas can do this with relative ease, but the mist, because of its greater momentum, collides with the vanes, collects, and drips down into a trough where it is piped back into circulation.

From the very beginning of operations of this system, calcium salts in the gas stream caused plugging of the wash nozzles in the mist eliminators. This resulted in a buildup of solids on the PVC mist eliminator panels and on the temperature detectors (see Exhibit E-2). The panels were constructed of PVC capable of withstanding 180° F. Although the highest temperature recorded was 145°F, the reduced spray flow and impaired temperature sensing capabilities resulted in severe damage to the mist eliminator panels (see Exhibit E-3).

Being part of the team responsible for identifying, diagnosing and eliminating these and several other problems was an extremely challenging task for Jerry Simpson. After all, the ink was hardly dry on his M.E. diploma.

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL DOMESTIC FGD SYSTEMS

COMPANY NAME	CENTRAL ILLINOIS PUBLIC SERV	
PLANT NAME	NEWTON	
UNIT NUMBER	1	
CITY	NEWTON	
STATE	ILLINOIS	
REGULATORY CLASSIFICATION	B	
PARTICULATE EMISSION LIMITATION - NG/J	43.	(.100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J	516.	(1.200 LB/MMBTU)
NOX EMISSION LIMITATION - NG/J	******	(****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW	575	
GROSS UNIT GENERATING CAPACITY - MW	617	
NET UNIT GENERATING CAPACITY W/FGD - MW	575	
NET UNIT GENERATING CAPACITY WO/FGD - MW	590	
EQUIVALENT SCRUBBED CAPACITY - MW	617	
** UNIT DATA - BOILER AND STACK		
BOILER SUPPLIER	COMBUSTION ENGINEERING	
BOILER TYPE	PULVERIZED COAL	
BOILER SERVICE LOAD	BASE	
DESIGN BOILER FLUE GAS FLOW - CU.M/S	1020.95	(2163480 ACFM)
BOILER FLUE GAS TEMPERATURE - C	163.9	(327 F)
STACK HEIGHT - M	162.	(530 FT)
STACK SHELL	CONCRETE	
STACK TOP DIAMETER - M	*******	(***** FT)
** FUEL DATA		
FUEL TYPE	COAL	
FUEL GRADE	BITUMINOUS	
AVERAGE HEAT CONTENT - J/G	25353.	(10900 BTU/LB)
RANGE HEAT CONTENT - BTU/LB		******
AVERAGE ASH CONTENT - %	12.70	
RANGE ASH CONTENT - %	******	
AVERAGE MOISTURE CONTENT - %	9.50	
RANGE MOISTURE CONTENT - %	******	
AVERAGE SULFUR CONTENT - %	2.25	
RANGE SULFUR CONTENT - %	2.0-2.5	
AVERAGE CHLORIDE CONTENT - %	.20	
RANGE CHLORIDE CONTENT - %	******	
*** PARTICLE CONTROL		
** MECHANICAL COLLECTOR		
NUMBER	0	
TYPE	NONE	
** FABRIC FILTER		
NUMBER	0	
TYPE	NONE	
** ESP		
NUMBER	1	
TYPE	COLD SIDE	
SUPPLIER	RESEARCH-COTTRELL	
INLET FLUE GAS CAPACITY - CU.M/S	1080.7	(2290000 ACFM)
INLET FLUE GAS TEMPERATURE - C	162.8	(325 F)
PRESSURE DROP - KPA	.0	(0. IN-H2O)
PARTICLE REMOVAL EFFICENCY - %	99.5	
** PARTICLE SCRUBBER		
GENERIC TYPE	NONE	
SPECIFIC TYPE	N/A	
*** FGD SYSTEM		
** GENERAL DATA		
SALEABLE PRODUCT/THROWAWAY PRODUCT	THROWAWAY PRODUCT	
SO2 REMOVAL MODE	WET SCRUBBING	
PROCESS TYPE	DUAL ALKALI	
SYSTEM SUPPLIER	BUELL DIVISION, ENVIROTECH	

Exhibit E-1

Design and Performance Data
for Newton I FGD

CENTRAL ILLINOIS PUBLIC SERV: NEWTON 1 (CONT.)

A-E FIRM	BUELL DIVISION, ENVIROTECH
DEVELOPMENT LEVEL	FULL SCALE
NEW/RETROFIT	NEW
UNIT DESIGN PARTICLE REMOVAL EFFICIENCY - %	99.50
UNIT DESIGN SO2 REMOVAL EFFICIENCY - %	90.00
CURRENT STATUS	1
COMMERCIAL START-UP	12/79
INITIAL START-UP	9/79
CONTRACT AWARDED	8/75

** DESIGN AND OPERATING PARAMETERS

** ABSORBER

NUMBER	4	
NUMBER OF SPARES	0	
GENERIC TYPE	PACKED TOWER	
SPECIFIC TYPE	MOBILE BED PACKING	
TRADE NAME/COMMON TYPE	POLYSPHERE SCRUBBER	
SUPPLIER	BUELL DIVISION, ENVIROTECH	
DIMENSIONS - FT	18 X 48 X 72	
SHELL GENERIC MATERIAL	MILD STEEL	
SHELL SPECIFIC MATERIAL	AISI 1110	
SHELL MATERIAL TRADE NAME/COMMON TYPE	N/A	
LINER GENERIC MATERIAL	ORGANIC	
LINER SPECIFIC MATERIAL	GLASS FLAKE-FILLED POLYESTER	
LINER MATERIAL TRADE NAME/COMMON TYPE	CEILCOTE	
GAS CONTACTING DEVICE TYPE	POLYSPHERE BALLS	
NUMBER OF CONTACTING ZONES	1	
DISTANCE BETWEEN GAS CONTACTING ZONES - CM	45.7	(18.0IN)
LIQUID RECIRCULATION RATE - LITER/S	148.	(2351 GPM)
L/G RATIO - L/CU.M	1.3	(10.0 GAL/1000 ACF)
GAS-SIDE PRESSURE DROP - KPA	1.5	(6.0 IN-H2O)
SUPERFICAL GAS VELOCITY - M/SEC	2.5	(8.3 FT/S)
SO2 REMOVAL EFFICIENCY - %	90.0	

** MIST ELIMINATOR

PRE-MIST ELIMINATOR/MIST ELIMINATOR	MIST ELIMINATOR
NUMBER PER SYSTEM	8
GENERIC TYPE	IMPINGEMENT
SPECIFIC TYPE	BAFFLE
TRADE NAME/COMMON TYPE	CHEVRON VANE
CONFIGURATION	VERTICAL

** REHEATER

NUMBER	1
GENERIC TYPE	BYPASS
SPECIFIC TYPE	COLD SIDE
TRADE NAME/COMMON TYPE	N/A

** FANS

NUMBER	4
DESIGN	CENTRIFUGAL
FUNCTION	BOOSTER
APPLICATION	FORCED DRAFT
SERVICE	DRY
CONSTRUCTION MATERIAL GENERIC TYPE	CARBON STELL

** SOLIDS CONCENTRATING/DEWATERING

DEVICE	VACUUM FILTER
NUMBER	1

** SOLIDS CONCENTRATING/DEWATERING

DEVICE	THICKENER
NUMBER	2
DIMENSIONS - FT	100 (DIA)
SHELL GENERIC MATERIAL TYPE	CONCRETE

** SOLIDS CONCENTRATING/DEWATERING

DEVICE	THICKENER
NUMBER	1
DIMENSIONS - FT	50 (DIA)

Exhibit E-1, cont.

EPA UTILITY FGD SURVEY: OCTOBER - DECEMBER 1980

CENTRAL ILLINOIS PUBLIC SERV: NEWTON 1 (CONT.)

SHELL GENERIC MATERIAL TYPE	STEEL
*** SLUDGE	
** TREATMENT	
METHOD	POZ-O-TEC
PROPRIETARY PROCESS	IUCS
** WATER BALANCE	
WATER LOOP TYPE	CLOSED
** FGD SPARE CAPACITY INDICES	
ABSORBER - %	.0
** FGD SPARE COMPONENT INDICES	
ABSORBER	.0

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/79	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS

INITIAL OPERATIONS BEGAN AT THIS UNIT ON SEPTEMBER 1 WHEN FLUE GAS WAS PASSED THROUGH THE INDIVIDUAL FGD MODULES FOR TESTING PURPOSES. TESTING OF THE SYSTEM IN AN INTEGRATED MODE IS EXPECTED TO BEGIN IN DECEMBER.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
10/79	SYSTEM							744			
11/79	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS

TESTING OPERATIONS CONTINUED THROUGH OCTOBER AND NOVEMBER.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
12/79	SYSTEM	75.3	60.1	74.1	59.0			744	730	439	

** PROBLEMS/SOLUTIONS/COMMENTS

THE UNIT BEGAN BURNING HIGH SULFUR COAL ON NOVEMBER 18-19 AT WHICH TIME THE FGD SYSTEM BEGAN OPERATIONS IN AN INTEGRATED MODE FOR THE FIRST TIME.

INITIAL START UP PROBLEMS HAVE INCLUDED MIST ELIMINATOR PLUGGING.

LINING FAILURES HAVE ALSO BEEN ENCOUNTERED DURING START UP PHASE.

THE UNIT PASSED A COMPLIANCE TEST ON DECEMBER 5, 1979. IT WAS DETERMINED THAT THE FGD SYSTEM CONTROLLED SO2 EMISSIONS TO WELL BELOW THE ALLOWABLE 1.2 LB/MM BTU STANDARD.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/80	A	68.3	57.1	63.5	55.5						
	B	66.4	60.6	64.9	58.9						
	C	52.2	48.8	60.5	47.4						
	D	21.0	19.1	26.3	18.5						
	SYSTEM	52.0	46.4	53.8	45.1			744	723	336	

** PROBLEMS/SOLUTIONS/COMMENTS

DURING JANUARY TESTS WERE CONDUCTED TO CERTIFY THE GAS EMISSIONS MONITOR AT NEWTON.

PRESATURATOR CORROSION AND EXPANSION JOINT REPAIRS AND A DEPLETION OF THE FLYASH USED FOR SLUDGE STABILIZATION ACCOUNTED FOR THE LOW JANUARY DEPENDABILITY FIGURES.

Exhibit E-1, cont.

CENTRAL ILLINOIS PUBLIC SERV: NEWTON 1 (CONT.)

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
2/80	A	61.1	42.4	45.0	42.4						
	B	74.4	55.7	57.7	55.7						
	C	78.2	58.5	59.1	58.5						
	D	.0	.0	.0	.0						
	SYSTEM	53.4	39.2	40.4	39.2			696	696	273	

** PROBLEMS/SOLUTIONS/COMMENTS

DURING FEBRUARY THE D-MODULE WAS UNAVAILABLE DUE TO THE COLLAPSE OF THE PRECOOLER MIST ELIMINATORS CAUSED BY A TEMPERATURE EXCURSION.

REPAIR WORK ON THE PRESATURATOR CORROSION AND EXPANSION JOINTS AS WELL AS THE FLYASH DEPLETION PROBLEM CONTINUED TO YIELD LOW DEPENDABILITY FIGURES FOR FEBRUARY.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
3/80	A	53.4	52.6	53.1	52.3						
	B	47.0	42.3	48.0	42.1						
	C	44.5	41.1	46.5	41.0						
	D	.0	.0	.0	.0						
	SYSTEM	36.2	34.0	36.9	33.9			744	740	252	

** PROBLEMS/SOLUTIONS/COMMENTS

DURING THE FIRST QUARTER, 1980, THE FOLLOWING PROBLEMS WERE ENCOUNTERED:
- THE VALVES AND PIPING IN THE PRECOOLER LOOP EXPERIENCED CORROSION.
- THE MIST ELIMINATOR ON THE D MODULE FAILED.
- THE FLY ASH SUPPLIES DEPLETED.
- RUBBER LINING AND DUCTWORK LINING FAILURES OCCURRED.
- BOOSTER FAN EXPANSION JOINT FAILURE OCCURRED.
- THE THICKENER EXPERIENCED PLUGGING.

THESE COMBINED PROBLEMS ACCOUNTED FOR THE LOW MARCH PERFORMANCE FIGURES. FOR THE QUARTER, THE TOTAL SYSTEM WAS AVAILABLE 47.2% AND WAS UTILIZED 39.4% OF THE TIME.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
4/80	A	33.8	31.3	31.4	31.3						
	B	35.4	25.8	25.8	25.8						
	C	37.4	35.6	35.6	35.6						
	D	26.1	21.8	21.8	21.8						
	SYSTEM	33.2	28.6	28.6	28.6			720	720	206	

** PROBLEMS/SOLUTIONS/COMMENTS

THE NEWTON 1 FGD SYSTEM WAS OUT OF SERVICE DURING THE FIRST 12 DAYS OF APRIL FOR NECESSARY REPAIRS ON THE OUTLET DUCT LININGS. THE UTILITY INDICATED THAT THE LINING FAILURES MAY HAVE RESULTED FROM IMPROPER APPLICATION.

DURING THE LAST 18 DAYS OF APRIL MINOR PROBLEMS WERE EXPERIENCED WITH THE OCCURANCE OF PLUGGING IN THE SODIUM CARBONATE THICKENER AND CORROSION OF THE VALVES IN THE PRESATURATOR CIRCUIT.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
5/80	A	.0	.0	.0	.0						
	B	9.7	9.6	9.6	6.2						
	C	9.7	9.6	9.6	6.2						
	D	.0	.0	.0	.0						
	SYSTEM	4.8	4.8	4.8	3.1			744	477	23	45.5

** PROBLEMS/SOLUTIONS/COMMENTS

DURING MAY, THE FGD SYSTEM WAS DOWN BECAUSE THE FLUIDIZING STONES WERE CAKED WITH FLY ASH. THIS WAS CAUSED BY IMPROPER WIRING OF THE HEATER WHICH BLOWS OVER THE STONES. THE HEATER WAS REWIRED AND THE FLUIDIZING STONES REPLACED. FLUIDIZING STONES ARE LOCATED IN THE FLYASH SILO. HEATED AIR PASSES THROUGH THESE POROUS STONES TO AERATE OR "FLUIDIZE" THE FLYASH SO

CENTRAL ILLINOIS PUBLIC SERV: NEWTON 1 (CONT.)

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR

THAT IT CAN BE CONVEYED TO THE FLYASH/SLUDGE MIXER. WHEN THE FLYASH SUPPLY IS DEPLETED OR THE MATERIAL CANNOT BE DELIVERED TO THE MIXER THE SCRUBBING SYSTEM IS SHUT DOWN. THE SLUDGE MUST BE TREATED WITH FLYASH BEFORE DISPOSAL.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
6/80	A	.0	.0	.0	.0						
	B	40.3	40.3	40.3	40.3						
	C	40.4	40.4	40.4	40.4						
	D	.0	.0	.0	.0						
	SYSTEM	20.2	20.2	20.2	20.2			720	720	145	63.0

** PROBLEMS/SOLUTIONS/COMMENTS

DURING JUNE THE A AND D MODULES WERE UNAVAILABLE FOR OPERATION BECAUSE THE MIST ELIMINATORS COLLAPSED.

THE SYSTEM WAS SHUTDOWN DURING THE FIRST HALF OF THE MONTH TO REPAIR THE DRY FLYASH COLLECTION SYSTEM WHICH ACCOUNTED FOR THE LOW B AND C MODULE FIGURES.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
7/80	A	3.5	3.7	3.7	3.5						
	B	3.6	3.9	3.9	3.6						
	C	.0	.0	.0	.0						
	D	.0	.0	.0	.0						
	SYSTEM	1.8	1.9	1.9	1.8			744	698	13	67.8

** PROBLEMS/SOLUTIONS/COMMENTS

DURING JULY PROBLEMS WERE ENCOUNTERED WITH THE MIST ELIMINATORS.

SOME OF THE SYSTEM OUTAGE TIME RESULTED FROM REPAIRS MADE NECESSARY BY THE OCCURRENCE OF CORROSION IN THE PRESATURATOR.

SCRUBBER PLUGGING DURING JULY CONTRIBUTED TO THE LOW FGD SYSTEM AVAILABILITY.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
8/80	A	.0	.0	.0	.0						
	B	64.7	50.2	50.2	49.3						
	C	51.2	34.1	36.9	33.5						
	D	37.6	21.9	24.0	21.5						
	SYSTEM	53.8	36.4	39.9	35.8			744	731	266	68.2

** PROBLEMS/SOLUTIONS/COMMENTS

PLUGGING PROBLEMS WITHIN THE FGD SYSTEM WERE THE CAUSE OF DOWN TIME IN AUGUST.

BECAUSE OF CHANGES IN SYSTEM OPERATIONS, ONLY 3 MODULES ARE NEEDED TO MEET CURRENT SO2 REGULATIONS.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/80	A	69.0	20.3	48.6	10.0						
	B	99.6	74.6	80.3	36.8						
	C	96.9	35.8	66.8	17.6						
	D	99.6	80.8	80.8	39.9						
	SYSTEM	99.1	67.8	82.5	33.4			720	355	241	33.2

** PROBLEMS/SOLUTIONS/COMMENTS

THE BOILER WAS TAKEN OUT OF SERVICE ON SEPTEMBER 16, 1980 FOR A SCHEDULED MAINTENANCE OUTAGE.

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
10/80	A	75.9	38.5	46.3	16.9						
	B	83.7	47.9	56.5	21.1						

Exhibit E-1, cont.

CENTRAL ILLINOIS PUBLIC SERV: NEWTON 1 (CONT.)

PERFORMANCE DATA											
PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	C	81.0	51.6	54.5	22.7						
	D	62.4	7.0	13.7	3.1						
	SYSTEM	75.8	36.3	46.3	16.0			744	328	119	30.4

** PROBLEMS/SOLUTIONS/COMMENTS

DURING OCTOBER THE FGD SYSTEM AVAILABILITY WAS LOW AS A RESULT OF LOW LIQUOR TEMPERATURES IN THE SCRUBBER FOLLOWING THE FOUR WEEK BOILER OUTAGE. THE LIQUOR WAS PREHEATED WITH STEAM TO PREVENT PLUGGING DUE TO THE "SALTING OUT" OF REAGENTS AT LOW TEMPERATURES.

11/80	A	93.6	69.9	98.2	69.9						
	B	79.6	59.9	100.0	59.9						
	C	89.4	58.8	97.2	58.8						
	D	79.6	70.1	99.0	70.0						
	SYSTEM	99.3	84.9	100.0	84.8			720	719	465	69.6

** PROBLEMS/SOLUTIONS/COMMENTS

THE UTILITY REPORTED THAT NO MAJOR OUTAGES OCCURRED DURING NOVEMBER.

12/80	A	64.5	45.9	63.8	45.7						
	B	71.5	68.7	72.2	68.4						
	C	72.7	42.1	63.4	41.9						
	D	71.5	52.8	66.7	52.6						
	SYSTEM	74.1	69.5	84.8	69.3			744	741		70.7

** PROBLEMS/SOLUTIONS/COMMENTS

FGD SYSTEM AVAILABILITY WAS LOWERED DURING DECEMBER AS A RESULT OF THICKENER PLUGGING PROBLEMS.

Exhibit E-1, cont.

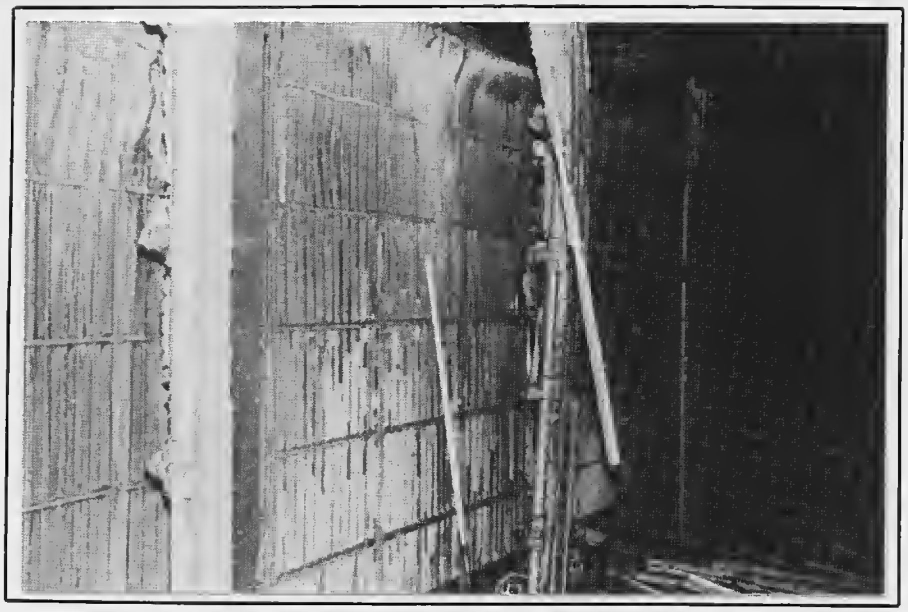

Exhibit E-2

Solids Accu-
mulate on Mist
Eliminator
Panels

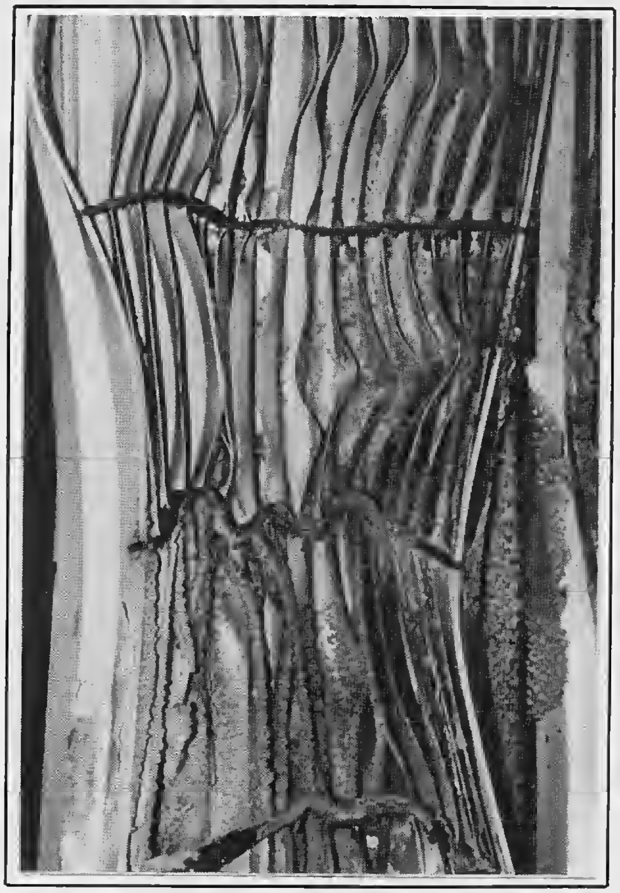

Exhibit E-3

Damaged Mist Eliminator
Panels

PART F: DAFGD SYSTEM MODIFIED

The Engineering Task Force

Jerry Simpson's responsibilities as test engineer at Newton I ended on December 1, 1979, two weeks before the DAFGD system began commercial operation. However, his involvement with Newton I was by no means over. His new assignment was as an Air Quality Engineer in the Environmental Affairs Department at CIPS headquarters in Springfield, Illinois. One of Jerry's new responsibilities was to collect data on the performance of CIPS power plants, including the information for the EPA survey on FGD systems which is reproduced in Exhibit E-1.

In an effort to improve the operation of the Newton scrubber, CIPS established an engineering task force which was charged with identifying, prioritizing, and eliminating the problems affecting the scrubber. The task force was made up of technical and engineering personnel from CIPS' Power Production and Power Plant Construction Department. Jerry Simpson was assigned to coordinate this work and to interface with state and federal regulatory authorities.

By Spring 1980 many of the problems had been diagnosed and Jerry joined his boss, R.J. Grant, Manager of the CIPS Environmental Affairs Department, in presenting a talk on the subject at the April meeting of the IEEE Power Engineering Society in Springfield.

Corrective Action Taken

As a result of the efforts of the task force, many modifications were made to the scrubber. By August 1980 most of the changes had been implemented. In particular, the chloride removal function of the precooler was eliminated, allowing higher pH liquor to be used in this loop. Also, the precooler mist eliminators, which had caused problems in the past, were removed and their use abandoned. These changes, together with various other alterations to system components led to considerably improved scrubber performance beginning in August 1980. Through all of 1981 and up to April 1982 the DAFGD system availability exceeded 96%. In May 1982, Jerry again co-authored a paper with his boss, this time at an EPA symposium in Florida. At that time, after recounting some of the initial difficulties at Newton I, they indicated that the modified system was performing exceptionally well. They concluded their talk by saying that the Newton I experience has demonstrated that "the dual-alkali technology does offer improved levels of performance and reliability than that of many of those systems previously available."

INSTRUCTOR'S NOTES

This case examines the efforts of one particular utility company to adopt a technology for reduction of pollution from a coal power plant. The case highlights the roles of two engineers--one who works for the utility company and the other whose duties at the Environmental Protection Agency deal with monitoring of compliance by the power plant with emission standards.

In addition to illustrating the technical aspects of a particular air pollution control technology, the case can be used to provide students with an opportunity to see how public policy decisions affect the engineering design process. While the public policy environment is one that has an increasingly large impact on the activities of modern engineers, this dimension of engineering is rarely covered in typical engineering courses. Because the relevant regulatory and legal issues are included as an integral part of this case, the student has the opportunity to explore the broader issues which affect engineering decisions while simultaneously enhancing his/her technical skills.

There are several modes of using this case; much is deliberately left to the instructor's choice. To increase the flexibility of the case and allow its use in more than one type of course, the case is organized into six main parts. Different instructors may choose to omit one or more of these parts to fit the case into different allotted time frames and/or to provide a particular focus on some aspects of the case.

Most upper-division engineering students using this case will have the appropriate technical skills to analyze the emission control system in some detail. In particular, Exhibits A-2 and E-1 contain considerable information on the technical characteristics of the system; that material could serve as the basis for many design and analytical problems, without necessarily getting heavily involved in the policy dimensions. However, bringing in speakers from your local utility may provide a real-world perspective.

There are some important lessons for engineering students that may come out of the non-technical aspects of this case. One concerns the ways organizations can act to further bureaucratic goals, rather than the nominal goals (in EPA's case, a clean environment). Another might be a short lesson on the legal process in the context of an engineering case. Should you wish to emphasize the legal issues, your local bar association would probably

be happy to provide a speaker with environmental law expertise. Additional legal materials associated with this case, including briefs and memoranda, are available from Dr. Hyman if you should want them. Also, the student who has gone through this case should have some feel for the impact that laws and regulations may have on technology, whether positive (creating a need for more sophisticated pollution control technology) or negative (seemingly inhibiting development of a new technology).

What follows are some suggested questions which could serve to focus class discussions and/or as the basis for assignments or examinations.

Part A: Design Decision Making

1. With regard to the EPA SO_2 emission standards in Exhibit A-1, why is the allowable emission level from liquid fuels (0.8 lb/10^6BTU) less than the allowable emissions level from solid fuels (1.2 lb/10^6BTU)? Why are the regulations applicable only to plants larger than 73 MW? Why does the size criterion apply to the input heat rate rather than the power output?

2. What other technologies are available to reduce the amount of sulfur in the exhaust stream (fluidized bed burners, washing the coal, etc.)? Compare the costs and efficiencies of these alternatives. How easy are they to operate? What waste streams do they have, and how dangerous are they? Which method removes the most sulfur? Why is treating the flue gases the current method of choice.

3. If you were an engineer at Sargent & Lundy, what criteria would you use in evaluating various scrubber proposals?

4. Shouldn't Chemico (the initially successful bidder) have been aware of the chemical composition of the Illinois coal and how it would affect their system? Why do you think this was overlooked? Should Sargent & Lundy also have been aware of the problem?

5. The spray tower precooler cools flue gases from 300-400°F to 130°F. Why does this change the solubility of HCl in water so much that 90% of the chlorides are removed from the flue gas? How does the presence of chlorine affect the scrubbing process?

6. What are the advantages of using a clear liquor instead of a slurry in the scrubbing loop?

Part B: Starting Up Newton I

1. CIPS claimed Newton I would not violate Ambient Air Quality Standards even without the scrubber. If so, why did they need a FGD system?

2. CIPS' claim regarding the effect of Newton I emissions was based on computer modelling. What is the State-of-the-art in computer modelling of the effect of power plant emissions on ambient air quality? Are the models accurate enough to provide sufficient certainty that the air quality standards would not be violated?

3. Analyze the technical arguments made by CIPS against burning high sulfur coal at Newton I as an interim measure. What are some of the economic and political arguments that might also be made? Should the ICPB be sensitive to such issues or should it confine its deliberations just to the technical considerations?

4. Go to the law library and try to locate the language in the Clean Air Act Amendments which gave Louisville Gas & Electric extra time to install their DAFGD. What is the rationale for such action without providing a similar break to CIPS?

Part C: EPA and CIPS Stake Out Their Positions

1. Why did EPA try to impose civil penalties (fines) on CIPS? Analyze the basis for setting the proposed fines at $25,000/day (see Exhibit C-2 for two approaches to deciding the level of the fines).

2. Assume you worked for CIPS. Prepare a request for an innovative technology waiver for Newton I (see Exhibit C-3 for the actual request). Assume you worked for EPA and prepare an an analysis of the CIPS request.

Part D: Resolution(?) of Legal Issues

1. Should CIPS have had to request an innovative technology waiver before starting operations at Newton I? Even though they may not have been required to do so, couldn't CIPS have applied for a waiver before start-up as a precaution? Should they have applied sooner?

2. Was EPA being overly rigid in its interpretation of the law in denying the waiver, or could they have felt CIPS was trying to force them into a position where they had to grant a waiver?

3. One of the main issues raised in the court suit was whether or not EPA's denial of the waiver was consistent with Congressional intent to encourage technical innovations. After reading the arguments presented by both sides (Exhibits D-2 and D-3), which do you feel is more persuasive? Do you feel it is appropriate or wise for Congress to encourage technological innovation through the use of such legislative techniques? What alternative approaches are available?

4. Do you think the settlement between CIPS and EPA was fair? Note that EPA never did rule on whether the Newton I FGD system was innovative. Why do you think that issue was left hanging?

5. What criteria would you use to determine whether a technology was innovative? Would the Newton I FGD system meet those criteria?

Part E: Operational Problems Encountered

1. In the FGD Survey (Exhibit E-1), the terms availability, operability, reliability, and utilization are used to describe the performance of the system. Define each term and distinguish between them.

2. Corrosion problems in the precooler were due to particles penetrating the protective rubber linings in the pipes and valves. Identify and analyze alternative solutions to this problem.

3. What corrective action would you recommend with regard to the mist eliminators?

Part F: DAFGD System Modified

1. Using hindsight, was CIPS decision to use a double alkali scrubber on Newton I instead of a more conventional technology a wise decision? If you were asked to select a scrubber for a new 1000 MW coal power plant (twice as big as Newton I), would you opt for a dual alkali system?